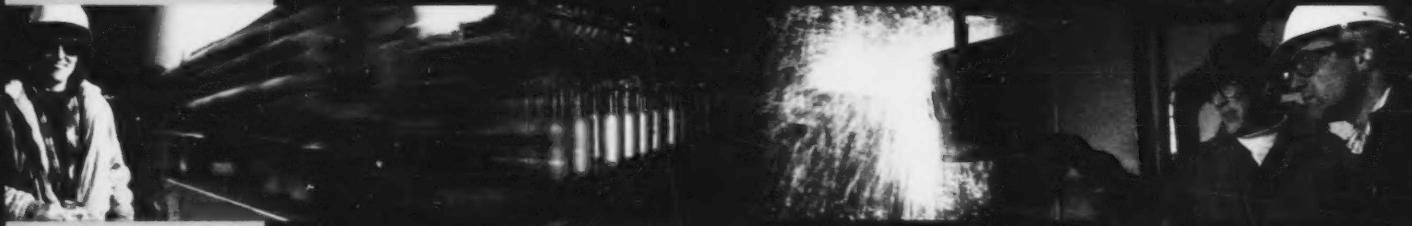
CIPEC 1975-2000



Canadian Industry Program for ENERGY CONSERVATION

1999/2000 ANNUAL REPORT

Natural Resources Canada
Office of Energy Efficiency

Ressources naturelles Canada
Office de l'efficacité énergétique

Canada

OEE

Office of Energy Efficiency
Office de l'efficacité énergétique

Leading Canadians to Energy Efficiency
at Home, at Work and on the Road

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OUR MISSION

To promote effective voluntary action that reduces industrial energy use per unit of production, thereby improving economic performance while participating in meeting Canada's climate change objectives.

Canadian Industry Program for Energy Conservation

1999/2000 ANNUAL REPORT

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CHAIRMAN'S LETTER

The Honourable Ralph Goodale
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Dear Minister:

I am honoured to present the Canadian Industry Program for Energy Conservation's (CIPEC's) *1999/2000 Annual Report*, the first since I assumed the Chair of CIPEC's Executive Board.

I am especially delighted that for our 25th anniversary year CIPEC is able to report solid progress toward Canada's goal of greater energy efficiency and reduced greenhouse gas emissions. Through effective energy management, CIPEC industries have achieved an average annual aggregate energy intensity of 2 percent per year for the period 1990–99. The energy saved is equivalent to 73 percent of Canada's residential heating demand in 1998.

Just as notably, the energy-management efforts of CIPEC industries have resulted in energy-related greenhouse gas emissions for the years 1990–99, registering 1.9 percent below 1990 levels, a significant aid to Canada's international climate change commitments. It is clear that the voluntary approach espoused by our organization delivers results.

Achieving this milestone has taken a great deal of work – by our 23 task forces and 38 industry trade associations, as well as the many companies from the manufacturing and mining sectors.

Interest in energy efficiency among individual companies continues to grow. Across the country, energy conferences and workshops sponsored by CIPEC sector task forces are attracting greater numbers of participants. Many companies are following seminar attendance with a new or renewed commitment to energy efficiency. In step with our goal of "more active companies in the program and more active programs in the companies," task force initiatives to increase CIPEC participation have also delivered results, with 50 companies joining the Industrial Energy Innovators Initiative in 2000 alone. The drive for industrial energy efficiency clearly has momentum.

CIPEC has made great progress in its first quarter century, thanks in large part to the Government of Canada's support for voluntary action. The combined resources of business and government have made CIPEC an exceptional success story and a model for other organizations around the world. With your continued encouragement and support, I am convinced that CIPEC will build on the outstanding results of its first 25 years to achieve even more in the years ahead.

W. Warren Holmes
Senior Vice-President, Canadian Mining Operations, Falconbridge Ltd.
Chair, CIPEC Executive Board

HOW CIPEC WORKS

CIPEC is an umbrella organization overseeing a partnership between government and private industry aimed at improving Canada's industrial energy efficiency. CIPEC is composed of sectoral task forces, each of which represents companies engaged in similar industrial activities who participate through their trade associations. The Task Force Council, with representatives from each CIPEC sector, provides a common forum for sectors to share ideas and recommend ways to address common needs. Overall direction is provided by an Executive Board made up of private sector leaders committed to industrial energy efficiency.

CIPEC's extraordinary public-private relationship is successful because it is built not on government regulation, but on trust. In the CIPEC partnership, voluntary change emerges from consensus and joint action built through open and honest communication.

CIPEC continues to be the focal point for the manufacturing and mining response to Canada's National Action Program on Climate Change. Our role is to promote the evolution of energy efficiency and to identify and reward those who lead the way.

We carry out this mandate in part through a strong communications and awareness program grounded in our twice-monthly *Heads Up CIPEC* newsletter and regular features in selected trade magazines. *Heads Up CIPEC*, which was first published three years ago with a circulation of 55, now has 2000 subscribers and boasts a readership of more than 6000. Our communications programs celebrate energy efficiency innovations and the industry leaders behind them and provide ideas to improve business and economic benefits through reductions in energy use.

CIPEC also raises awareness of the goals and benefits of improved energy in other ways. Non-competitive information is exchanged at regular sector task force meetings. The Task Force Council and individual sectors are constantly at work to broaden participation and to bolster public and industry awareness of the role and achievements of CIPEC industries.

CIPEC volunteers include successful business leaders and others recognized on the national stage. The quality and profile of these leaders and their strong belief in voluntary change without government regulation give CIPEC a strong edge in attracting new industry participants and in continuing the successful partnership between industry and government.

VOLUNTARY CO-OPERATION YIELDS IMPRESSIVE RESULTS

The Canadian Industry Program for Energy Conservation's (CIPEC's) silver anniversary was truly a landmark year for an exceptional organization. Throughout 1999/2000, the ongoing efforts of hundreds of people in the public and private sectors across Canada enabled CIPEC to establish milestones, which proves, yet again, that voluntary co-operation between business and government can deliver impressive results. Notably, CIPEC has demonstrated growing momentum and a record of achievement unmatched by any organization of its type in the world.

HERE ARE A FEW OF THE ORGANIZATION'S MOST SIGNIFICANT ACHIEVEMENTS IN 1999/2000

- Companies under the CIPEC umbrella averaged an energy intensity improvement of 2 percent per year between 1990 and 1999, well above the 1-percent-per-annum improvement commitment made in 1994. For the period 1990–99, the total energy saved by Canadian industry is equivalent to 73 percent of Canada's residential heating demand in 1998.
- Thanks to effective energy management, CIPEC industries reduced energy-related greenhouse gas (GHG) emissions to 1.9 percent below 1990 levels by 1999, a significant aid to Canada's international climate change commitments.
- The addition of two new task forces during the past reporting period means that there are now 23 task forces participating in CIPEC.
- Association participation has also increased as four new trade associations signed letters of co-operation, bringing total participation to 38 trade associations.

- At the time this report was being written, 294 companies had made individual commitments as Industrial Energy Innovators, an increase of 50 companies from the previous year. The growth in this number indicates an increasing awareness of the importance of energy management to the success of businesses in all sectors.

Natural Resources Canada's (NRCan's) statistics indicate that energy use by CIPEC industries has increased just 9.1 percent between 1990 and 1999, while their gross domestic product (GDP) has risen by 31.5 percent.

Effective energy management is doing good things for the environment, as well as improving the bottom line of Canadian business. The investments made in energy-saving technology and the implementation of efficient new processes are helping participating businesses to cut costs and increase profits. Companies are discovering that energy efficiency improvements are almost always linked to gains in business performance.

All of CIPEC's remarkable success comes solely from voluntary efforts on a national scale. With the government's support, energy efficiency initiatives are emerging from nearly every industrial sector in Canada. Individually and together, manufacturing and mining companies are helping Canada to improve its energy efficiency, cut its GHG emissions and meet its international climate change commitments.

This report documents the results achieved by mining and manufacturing companies in the 1999/2000 reporting year. It also highlights a few of the companies who have backed their commitment to energy efficiency with action and presents the statistics behind their combined success.

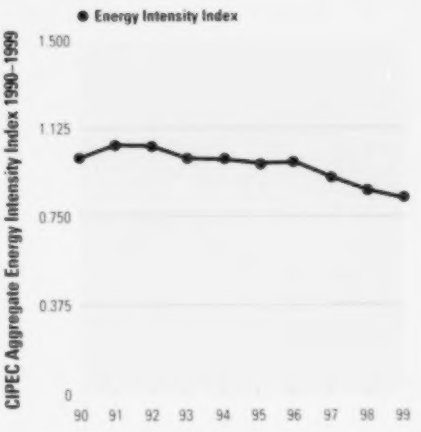
THE EVOLUTION OF CIPEC DATA

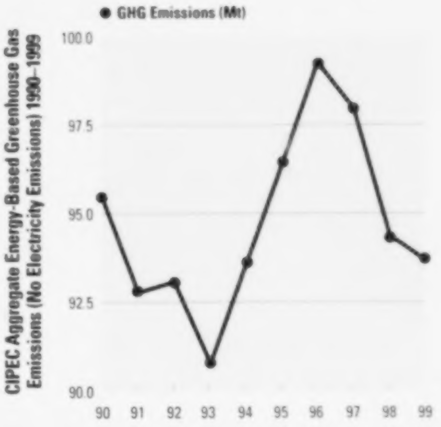
Accurate measurement and meaningful data are fundamental to measuring energy efficiency improvements. The data used in this report are collected by Statistics Canada and interpreted by the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University in Burnaby, British Columbia. From Statistics Canada data, CIEEDAC produces energy intensity indicators for each sector based on production and GDP. CIPEC continues to collaborate with Statistics Canada and CIEEDAC in ongoing efforts to ensure measurement accuracy and acceptability.

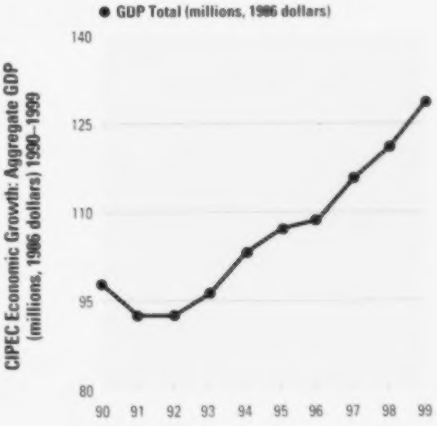
The co-operative CIEEDAC system is internationally recognized for its methodologies, data integrity and co-operation with CIPEC. Primary funding for CIEEDAC comes from CIPEC and NRCan with additional contributions from industry associations and the province of Quebec.

CIPEC IN GROWTH MODE

Although it is the world's oldest voluntary industrial energy efficiency program, CIPEC continues to widen its influence within Canada's industrial and mining communities. In fact, participation in CIPEC is at an all-time high. There are now 23 sectoral task forces encompassing 38 trade associations. Collectively, they represent approximately 90 percent of secondary industrial energy demand.







Equally important, the engagement of individual company participation within these sectors is increasing. Since the last report, the number of organizations signing on as Industrial Energy Innovators has grown by more than 50. Companies are flocking to energy conferences in record numbers and are following up by making major capital and operational commitments to improve energy efficiency.

IMPRESSIVE RESULTS

Effective energy management is having a positive effect on Canada's energy intensity. CIPEC's overall annual average aggregate improvement in energy intensity from the 1990 base year through 1999 is 2.0 percent per year, exceeding CIPEC's overall target of 1.0 percent per year. From 1990 through 1999, energy-use-related GHG emissions were 1.9 percent below 1990 levels.

A weakening economy will now challenge CIPEC industries to build on existing momentum. The extent of capital investment in new technologies – regardless of their returns – is dictated by the size of the corporate balance sheet. Reduced revenue, arising from declining sales, means less money for continuing improvements. On the other hand, opportunities may arise to develop innovative financing techniques through "out of the box" thinking. The CIPEC business plan includes efforts to draw upon the collective thinking of the engineering and financial communities to help industry come up with creative solutions to continue going forward.

INDIVIDUAL EXCELLENCE

Many companies active in CIPEC sectors achieved energy efficiency excellence in the 1999/2000 year. We highlight 11 such companies in the "Success Stories" section of this report. In addition, three companies are among the recipients of Canada's Energy Efficiency Awards 2000, administered by NRCan's Office of Energy Efficiency (OEE). The awards recognize companies in all sectors of the economy that exhibit excellence in their energy efficiency efforts.

Companies that received the awards are:

- Crown Cork & Seal Canada Inc., for a program to capture air compressor waste heat and use it to preheat water for washing cans at its Calgary, Alberta, plant. This common-sense approach has reduced

INNOVATION AND CANADA'S CLIMATE CHANGE VOLUNTARY CHALLENGE AND REGISTRY INC. (VCR INC.)

The Industrial Energy Innovators Initiative helps companies put sector-level commitments into action at the individual corporate level. At the time this report was being written, 294 companies representing approximately 80 percent of industrial energy use had signed on as Industrial Energy Innovators. The majority of these companies are participants in VCR Inc.

CIPEC has strengthened the participation of Industrial Energy Innovators in VCR Inc. through a number of programs. These include programs to increase awareness of the economic benefits of improved energy use and tools to remove barriers hindering energy-management improvement projects within companies. CIPEC believes that parallel efforts among like-minded organizations are needed to maximize Canada's industrial energy efficiency.

natural gas consumption for boiler operations by 5 percent and is saving $12,000 a year in energy costs.

- Lake Erie Steel Co. for using waste steam generated from blast furnace gas to power compressors in the smelter's cryogenic air-separation plant. As a result of this creative approach, the company has reduced its electricity costs by about $1.7 million annually and achieved significant and enduring environmental benefits.
- DuPont Canada Inc., for improving its per-unit energy consumption by 28 percent between 1990 and 1999 through research, effective networking and the strategic application of new energy technologies. The company's Manufacturing Energy Management Team has provided leadership in integrating energy conservation and energy efficiency opportunities with DuPont's constantly evolving business priorities.

CIPEC, itself, has also been recognized for excellence. NRCan's OEE has awarded the organization a Special Recognition Award, citing CIPEC's important, lasting and ongoing contribution to the field of energy efficiency in Canada. CIPEC was also awarded the 1999 Association Leadership Award by Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.).

NEW TARGETS

On October 11, 2000, CIPEC's Executive Board announced that it had extended its energy intensity improvement target for another five years. The new target aims to improve energy intensity by 1 percent per year between 1990 and 2005. Given the present economic slowdown, this may be a greater challenge than anticipated because of capital rationing – at least in the short term. As well, it will become increasingly difficult to exploit so-called low-hanging fruit.

A NEW LEADER

In 2000, CIPEC named W. Warren Holmes as Chairman of its Executive Board. Mr. Holmes is Senior Vice-President, Canadian Mining Operations, Falconbridge Ltd., and succeeds Peter H. Cooke, Executive Vice-President, Cement, Lafarge Corporation. Mr. Holmes has 35 years of experience in the mining industry, working first with Noranda Mines Ltd. and, since 1986, with

Falconbridge Ltd. Mr. Holmes is on the boards of the Ontario Mining Association and the Mining Association of Canada and has received a number of industry awards.

Mr. Holmes brings a wealth of experience to this position from his work in the industry as well as on mining association boards. His knowledge, experience and commitment to energy efficiency will make a valuable contribution to CIPEC's ongoing drive to reduce industrial energy intensity.

A NEW FOCUS

In 2000, CIPEC established a new three-year business plan. The plan has set as the organization's goal "more active companies within the program, and more active programs within the companies." Our intention is to continue to broaden CIPEC's reach by encouraging non-participating companies to become Industrial Energy Innovators. We are also seeking to deepen the involvement of companies in all sectors, encouraging them to establish active, formal energy efficiency programs within their operations. This mission is aided by a growing awareness within Canadian industry of the role CIPEC has played in helping companies strengthen their competitive position through improved energy management. As competitors move ahead, no company can afford to be left behind.

THE TASK AHEAD

To encourage more active companies within the program, and more active programs within the companies, CIPEC must expand the reach of its activities and develop new initiatives to broaden and deepen participation. We have established a new three-year target, and we must continue to ensure that we have a full toolbox available to companies seeking to help us meet that target.

This will take commitment from government and from the private sector. CIPEC's exceptional vitality comes from the willingness of both partners to embrace the cause of energy management and to invest both money and time in achieving it. CIPEC has a vital mission, and important work lies ahead if Canada is to meet its international climate change commitments and ensure a secure future for coming generations. CIPEC has achieved a great deal over its 25 years. We must continue to build on these successes in the years to come.

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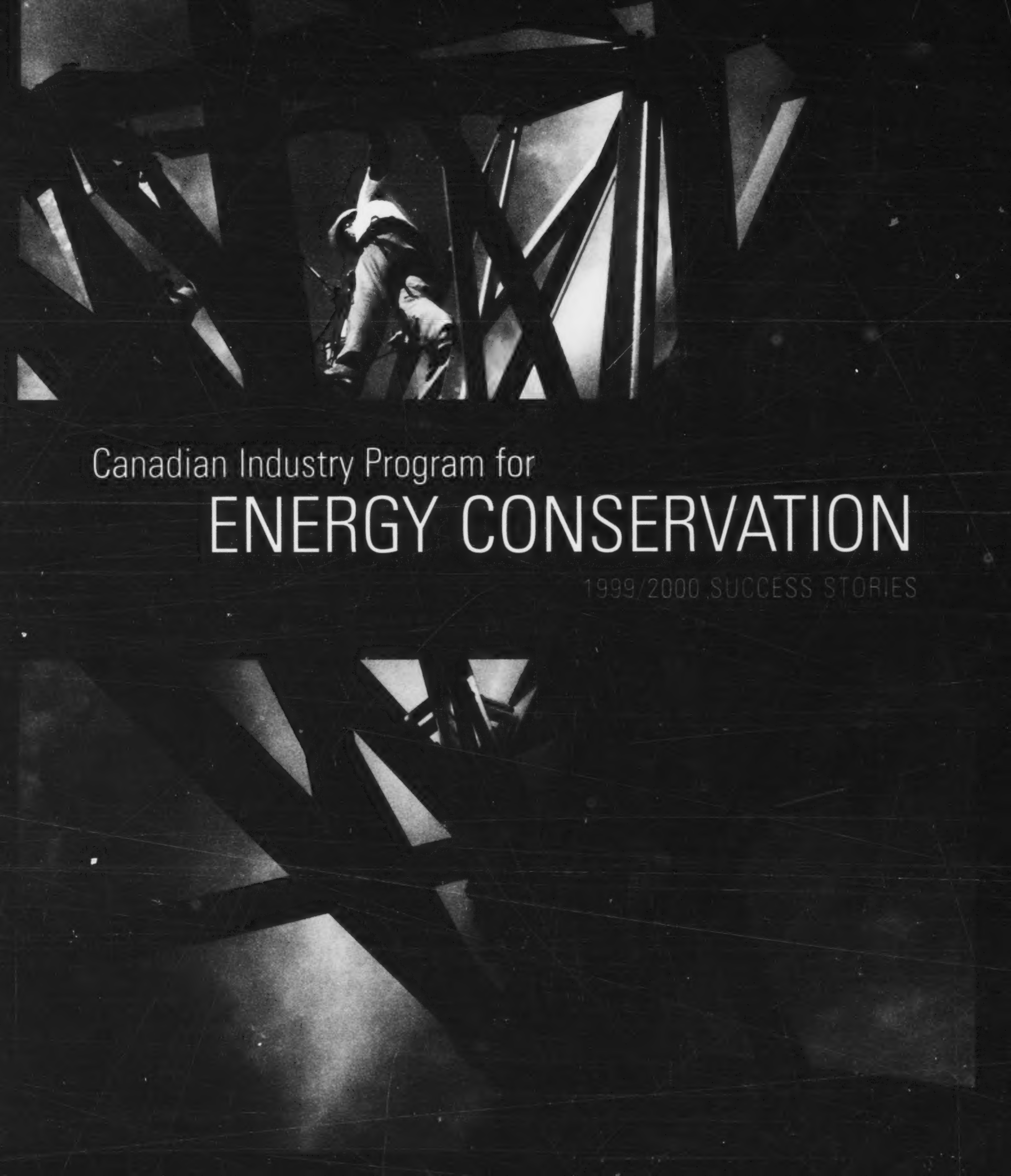
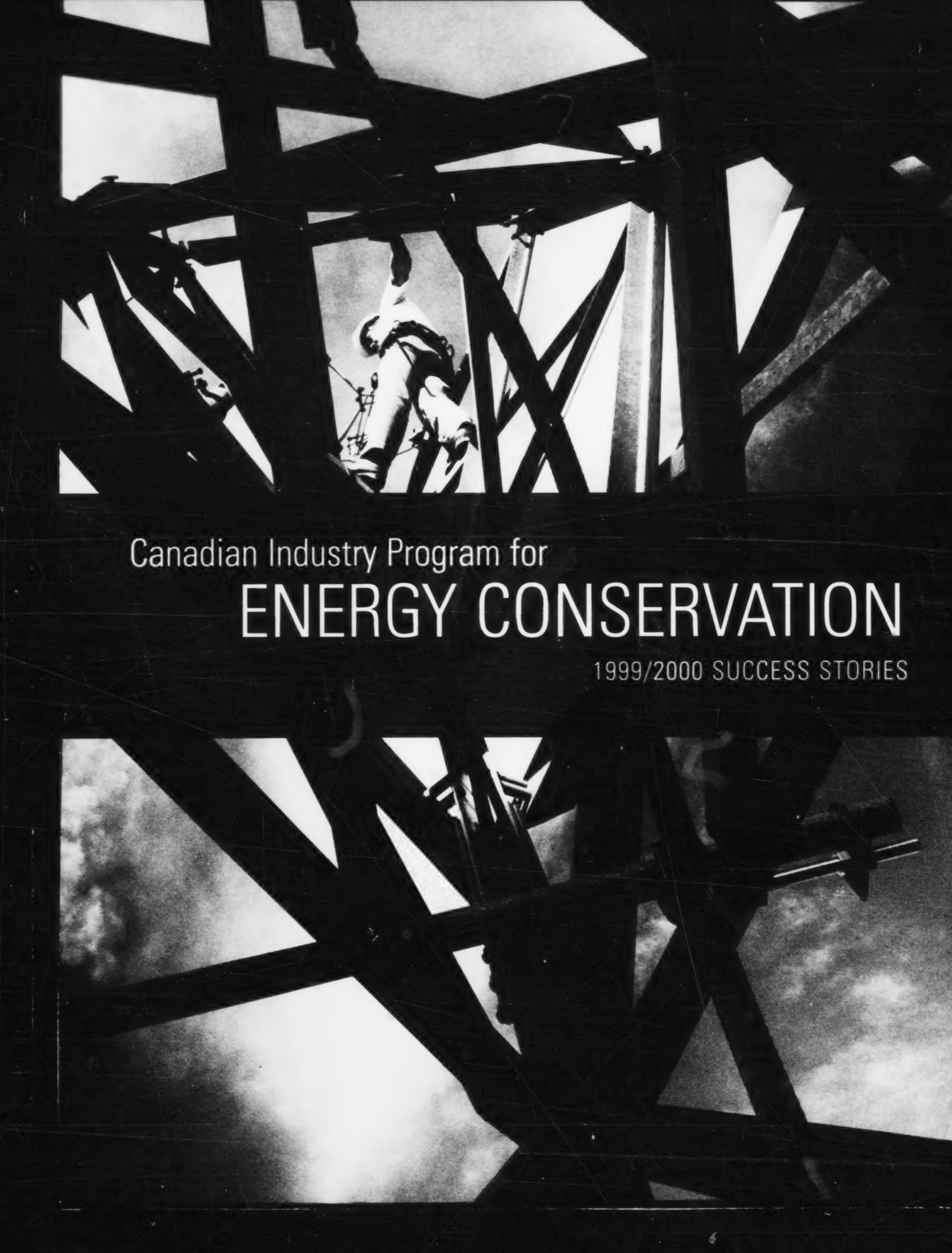


Canadian Industry Program for ENERGY CONSERVATION

1999/2000 SUCCESS STORIES



Canadian Industry Program for

ENERGY CONSERVATION

1999/2000 SUCCESS STORIES

Innovation in ACTION

In this section are 11 Canadian success stories. They tell of 11 committed companies that have taken decisive action to achieve energy efficiency in their operations. We would like to share these stories with you in this, the 25th anniversary of CIPEC's remarkable voluntary partnership between the private and public sectors.

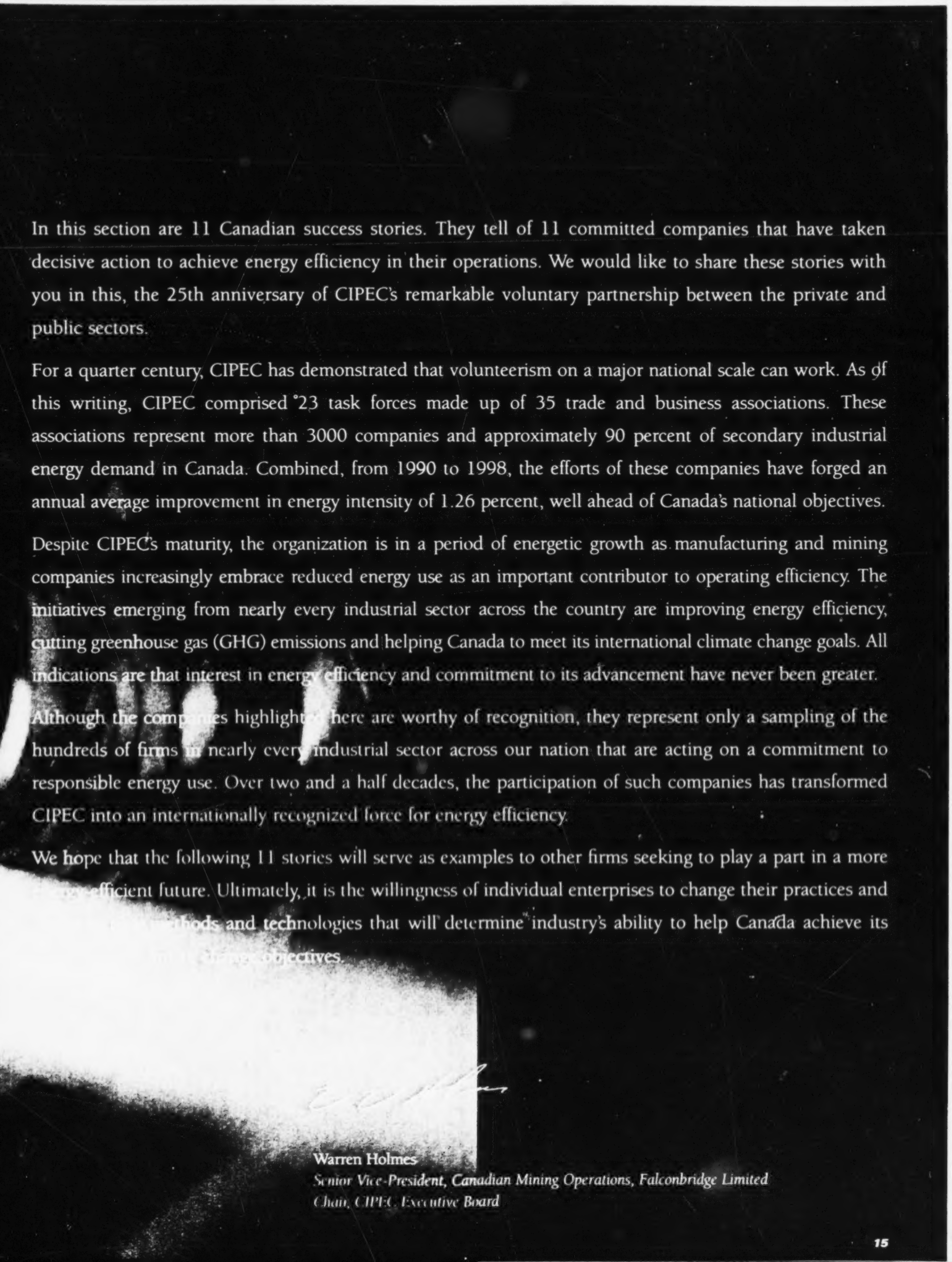
For a quarter century, CIPEC has demonstrated that volunteerism on a major national scale can work. As of this writing, CIPEC comprised 23 task forces made up of 35 trade and business associations. These associations represent more than 3000 companies and approximately 90 percent of secondary industrial energy demand in Canada. Combined, from 1990 to 1998, the efforts of these companies have forged an annual average improvement in energy intensity of 1.26 percent, well ahead of Canada's national objectives.

Despite CIPEC's maturity, the organization is in a period of energetic growth as manufacturing and mining companies increasingly embrace reduced energy use as an important contributor to operating efficiency. The initiatives emerging from nearly every industrial sector across the country are improving energy efficiency, cutting greenhouse gas (GHG) emissions and helping Canada to meet its international climate change goals. All indications are that interest in energy efficiency and commitment to its advancement have never been greater.

Although the companies highlighted here are worthy of recognition, they represent only a sampling of the hundreds of firms in nearly every industrial sector across our nation that are acting on a commitment to responsible energy use. Over two and a half decades, the participation of such companies has transformed CIPEC into an internationally recognized force for energy efficiency.

We hope that the following 11 stories will serve as examples to other firms seeking to play a part in a more energy-efficient future. Ultimately, it is the willingness of individual enterprises to change their practices and invest in new methods and technologies that will determine industry's ability to help Canada achieve its international climate change objectives.

Warren Holmes
Senior Vice President, Canadian Mining Operations, Falconbridge Limited
Chair, CIPEC Executive Board



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3M Canada Company

A Global View on

Greenhouse Gases

3M Canada Company is a significant contributor to its parent company's worldwide efforts to boost its energy efficiency by 15 percent between 1995 and the end of 2000.

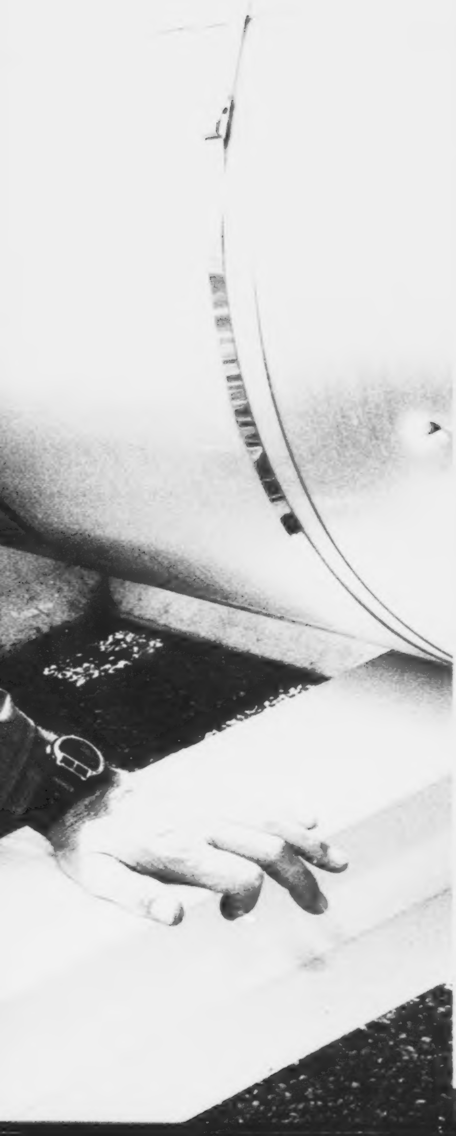
No newcomer to energy conservation, 3M Canada has made major advances toward meeting this target. It has used a number of means, including life-cycle management, process optimization, improved operating procedures and capital investments such as the installation of high-efficiency motors, heat recovery from steam and exhaust streams, and re-lighting. As a result, the company's manufacturing facilities have already reached their energy reduction targets, and other operations are below the trend line.

The company has moved beyond energy cost considerations to GHG concerns. Internationally, 3M is drafting a corporate position and action plan related to global warming. In Canada, the company began tracking its GHG emissions three years ago, a practice that is enabling it to set goals and benchmark its continuously improving environmental performance. Directly tied to energy consumption, GHG tracking includes everything from plant processes to company vehicles. With six manufacturing sites in Ontario and Manitoba and sales offices in major cities across Canada, 3M's GHG monitoring program is a significant means of gathering important decision-making data to effectively reduce GHG emissions.

Boeing Toronto Limited

Energy Conservation

at Boeing



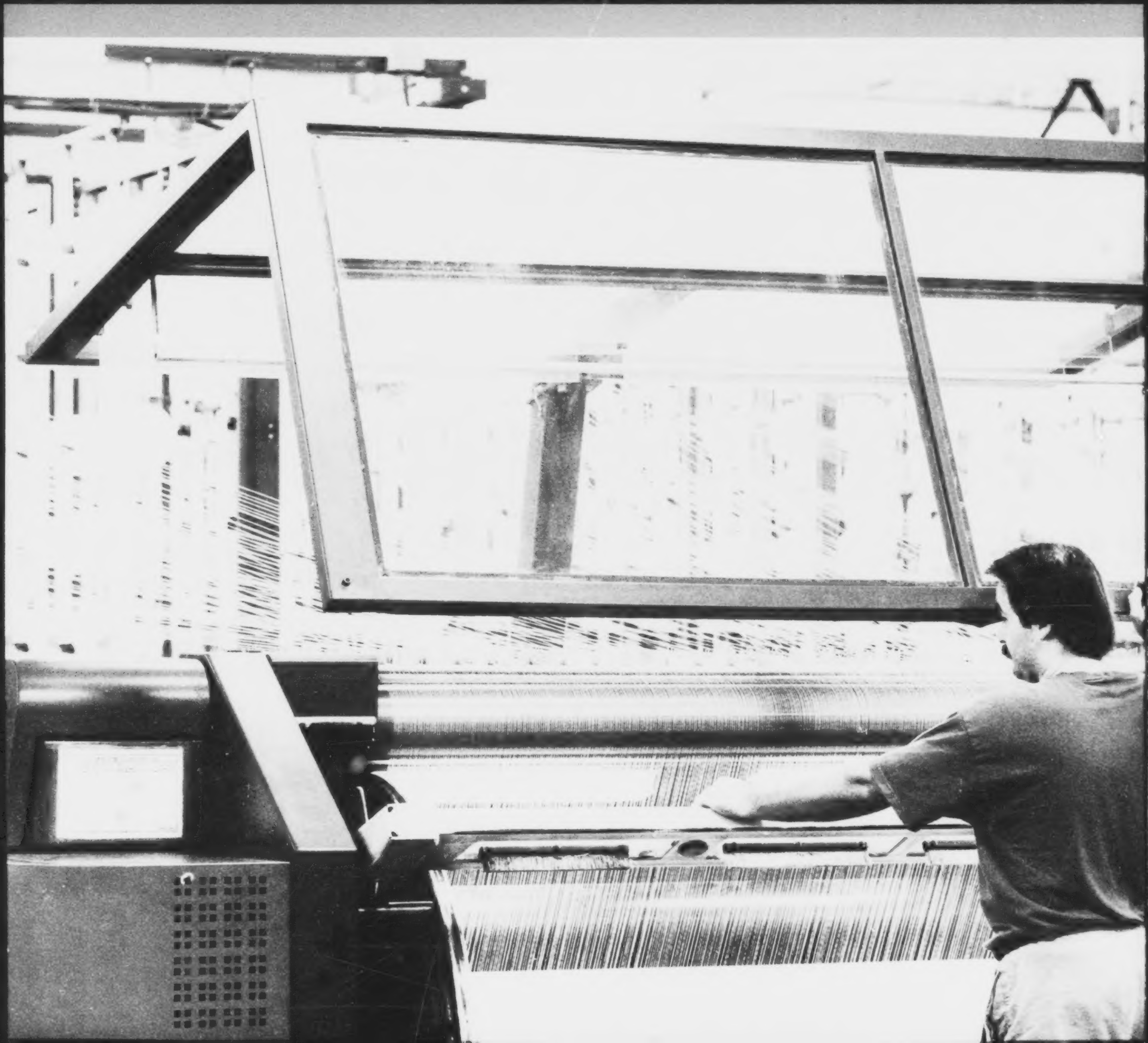
oeing Toronto Limited's energy-reduction strategy is saving the company a quarter of a million dollars per year.

The company installed an upgraded energy-management system at its Toronto facility that monitors its heating, ventilating and air-conditioning (HVAC) systems and employs immediate electricity load shifting and shedding as demand changes. Boeing also retrofitted the HVAC system that serves its offices to better control air temperature. The system is now equipped with a manual override that saves on operating costs during off-peak and weekend periods. The company revamped its ventilation systems to cut down unnecessary airflow, reduce heating-coil operation and enable the shutdown of 17 exhaust fans. A major lighting retrofit replaced 1800 office-area fixtures with energy-efficient T-8 lamps and electronic ballasts. This move not only saves on lighting costs—the reduced heat generated by the new lamps also cuts air-conditioning loads.

Steam for heating accounts for two-thirds of the Toronto facility's total energy consumption. By purchasing by-product steam from a neighbouring cogeneration plant and installing steam-pressure reduction technology, the company is saving substantially on its energy costs. In total, Boeing Toronto's energy initiatives have reduced its energy consumption by 14 percent, leading to an investment payback of less than two years.

Consoltex Inc.

Energy Efficiency



Looms Large for Textile Company

The textile giant Consoltex Inc. took action when energy audits of its facilities in 1995 identified opportunities for improvement.

The company introduced a five-year program at its Alexandria (Ontario) and Montmagny (Quebec) plants to improve insulation and reduce heat loss by replacing roofs, windows and doors. At its finishing plant in Cowansville (Quebec), the company installed a Solarwall®, which recovers heat energy from the building and the sun while still allowing air exchange. In all of its five facilities, a lighting retrofit is replacing older, inefficient equipment with energy-efficient metal halide systems. The company has also launched improvements to its compressed-air systems, including the installation of diaphragms to optimize air utilization and repairing air leaks on its jet looms. These programs and others that are under way throughout the company have cut energy costs while reducing effluent discharges and stack emissions.

By monitoring its energy use on an ongoing basis, keeping employees involved in its environmental program and committing itself to continuously improving its energy efficiency, Consoltex is making strong progress toward a targeted 5-percent reduction in energy used per unit of production.

Husky Injection Molding Systems Ltd.

An Environmental

State of Mind

Husky Injection Molding Systems Ltd. has issued a challenge to each of its businesses: rethink the way things are done to become as energy efficient as possible.

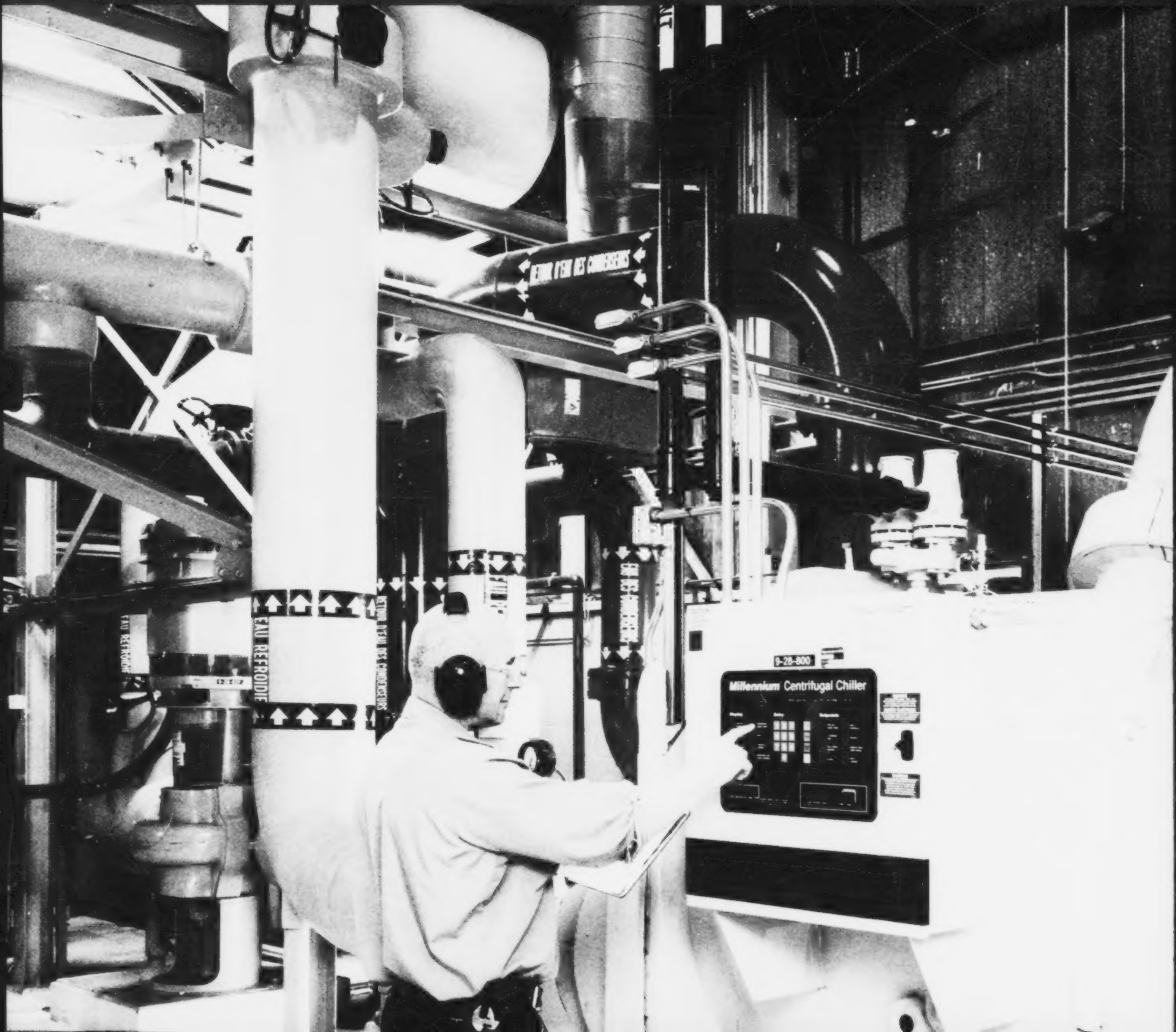
Its businesses are responding. When four new buildings were added at the company's complex in Bolton, Ontario, in the 1990s, the latest energy and environmental innovations were incorporated into their design. From pre-cast wall sections and argon-filled windows to energy-efficient motors and hand dryers, all building systems were designed to be environmentally friendly.

Throughout its growing campus, Husky has introduced a number of energy-saving projects that range from upgrades to transformers to the use of occupancy sensors to control lighting systems. Combined improvements made throughout the 1990s have led to annual power savings of nearly 595 000 kWh and natural gas savings of more than 500 000 m^3.

At the beginning of 2000, Husky launched "GreenShares," a program that rewards employees who make climate-change-conscious decisions part of their daily lives with shares in the company. By establishing a sound environmental policy within its own operations and promoting it in the community, Husky has become a recognized leader in the march toward energy efficiency.

IBM Canada Ltd.

Energy Master Plan


RETOUR D'EAU DES CONDENSEURS
EAU REFROIDIE
EAU REFROIDIE
RETOUR D'EAU DES CONDENSEURS
Millennium Centrifugal Chiller

Drives Efficiency at High-Tech Firm

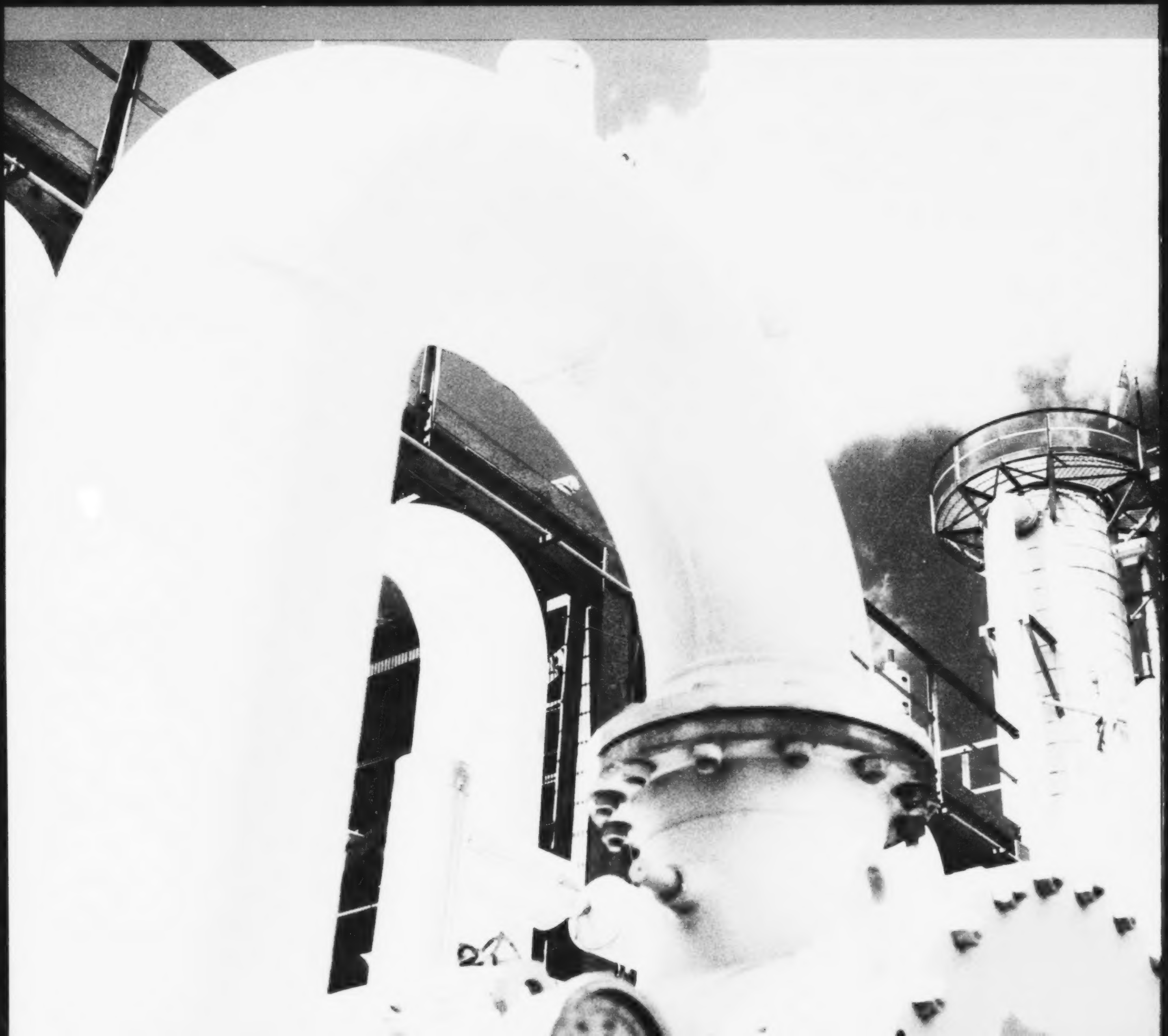
BM Canada Ltd. wants to be known as a leader—not only in technology but in environmental conservation as well.

It is pursuing this quest with a concerted effort to improve energy efficiency. The company's Energy Master Plan, part of its ISO 14001 Environmental Management System, includes annual submissions by all of its major locations. This enables IBM to track its overall performance and assist local sites to manage their energy-conservation efforts. The company is combining energy efficiency initiatives (including manufacturing process improvements and infrastructure upgrades to lighting, motors and HVAC control) with operational efficiency programs such as space and site consolidation to substantially improve its energy picture.

The results have been impressive. For example, in 1998 an HVAC optimization program and other efforts resulted in power savings of nearly 20 000 MWh. The company's 1999 program, which included lighting retrofit projects and improvements to water-handling systems at one of its large plants, targeted a 4-percent reduction in energy use. In total, from 1990 to 1998, the company has reduced its use of energy by 36 percent and slashed its carbon dioxide emissions by 32 percent. These gains are helping the company to save on its energy expenditures while minimizing the impact of its operations on the environment.

NOVA Chemicals Corporation

Energy Efficiency Brings



the Right Chemistry to NOVA Chemicals

Industrial Energy Innovator NOVA Chemicals Corporation is finding new ways to do more work with less energy throughout its operations.

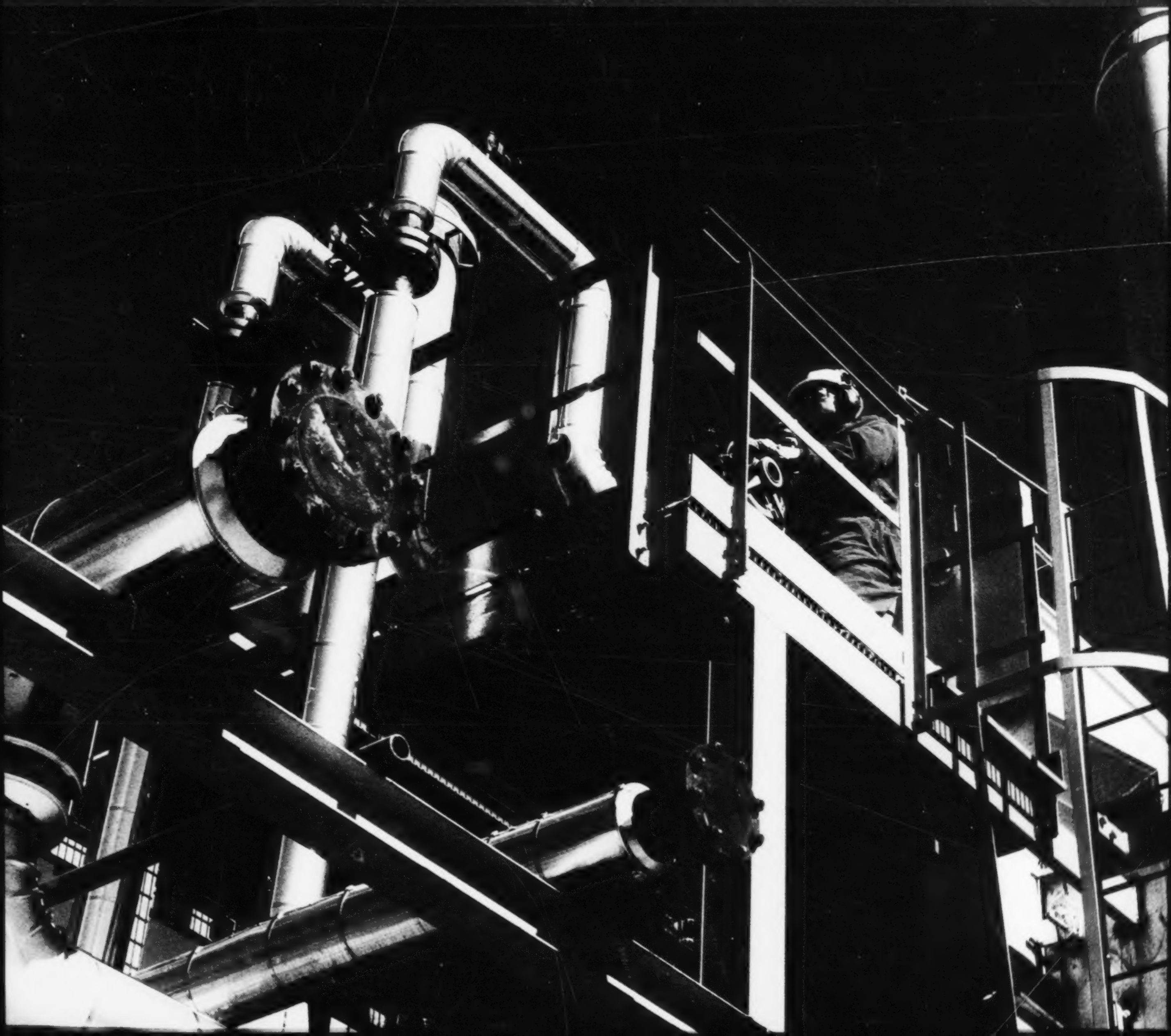
At its site in Joffre, Alberta, NOVA Chemicals is building a $380-million cogeneration plant to supply all of the site's steam and electricity needs. By also supplying electricity to the Alberta Interconnected System, the plant will reduce indirect emissions of GHG by system users by approximately 2546 kilotonnes annually. At the company's facility in Corunna, Ontario, a flare-reduction program is reducing emissions and improving fuel efficiency. NOVA Chemicals is also evaluating the recovery of by-product carbon dioxide for commercial sale. Positive initial results have led the company to continue its research.

Looking closely at its processes, NOVA Chemicals has successfully tested the use of lower temperatures in the ethylene furnaces at Joffre, demonstrating that it is possible to improve productivity and save fuel. In addition, the company is actively seeking ways to improve the efficiency of its energy-intensive distillation processes.

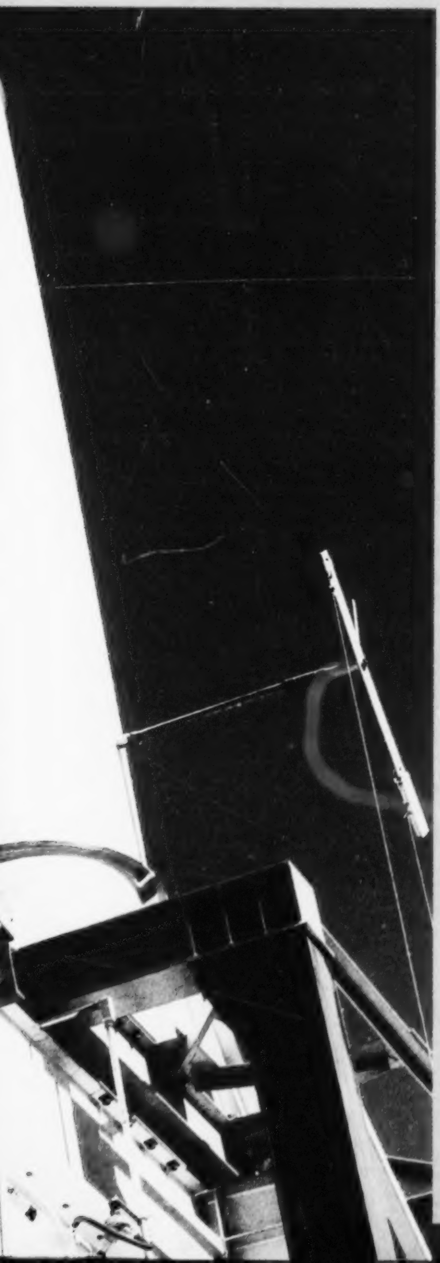
It takes a lot of energy to produce more than 4 million tonnes of ethylene and polyethylene each year. Thanks to fresh thinking and a willingness to invest to improve its performance, NOVA Chemicals has become an industry energy efficiency leader.

Parkland Refining Ltd.

Thinking Small



Brings Big Return to Parkland



Producing 6300 barrels per day, Parkland Refining Ltd.'s refinery in Bowden, Alberta, is one of the Canadian industry's smallest. But with an energy efficiency index improvement of more than 25 percent over the last decade, Parkland has achieved big-time results.

The refinery has achieved its most significant energy cost savings by increasing production. Increased throughput has enabled process heaters to operate at optimum efficiency and spread heat losses over greater volumes of production, leading to a 10-percent efficiency gain. The installation of new platformer exchangers in 1995 has enabled more heat to be captured and returned to the process, while a new, more efficient crude heater has also boosted energy efficiency. Together, this equipment has improved energy efficiency by 7 percent.

Parkland has also paid close attention to the small details of energy consumption. The company installed variable-speed drives for air-cooler fans and is ensuring that all replacement electric motors throughout the refinery are high-efficiency units.

Parkland Refining is living proof that no matter what the size, a company that is motivated to improve its facilities, processes and practices can make large gains in energy efficiency.

PCI Chemicals Canada, Inc.

2-Percent Solution

Energy Efficiency

CI Chemicals Canada, Inc. knows that when you're a big power user, improvements as small as 2 percent can have a major impact on your operating costs.

For example, by re-rating equipment at its facility in Dalhousie, New Brunswick, to operate at higher temperatures, the company improved the facility's energy efficiency by 2 percent—a substantial gain for an operation using 28 MW of power each year. Another 2 percent was cut by converting one of the plant's chemical waste streams into usable product. Since 1993 the plant has used hydrogen—a by-product of its processes—as a non-polluting boiler fuel, and it has recently launched a project to divert waste steam from one operation for use in another.

At its facility in Bécancour, Quebec, PCI has invested $30 million to expand production and reduce energy usage. The company installed state-of-the-art membrane cells that increase the plant's chlor-alkali capacity by 12 percent. The cells are also 20 to 25 percent more efficient than their alternatives, enabling the company to substantially decrease energy usage per tonne of production.

By combining innovative thinking with investments in new technology, PCI Chemicals Canada continues to advance the cause of energy efficiency.

S.C. Johnson and Son, Limited

Improving Energy

Efficiency Takes a Team Effort

Key employees at S.C. Johnson and Son, Limited are working together to reduce the energy used per unit of production.

An interdepartmental team of senior managers is steering the company's efforts as it looks at all corners of the company's operations in Brantford, Ontario, and introduces improvements. The goal is a reduction in energy used per unit of production of 15 percent by the end of 2000. Thanks to teamwork throughout the company, S.C. Johnson reduced energy consumption per unit of production by 9.7 percent by the end of 1999 compared to its 1995 base year.

The company continues to take advantage of energy-efficient technologies. For example, a lighting retrofit at the beginning of the year modernized all illumination systems in its 32 500 m^2 (350 000 sq. ft.) facility. In the summer, the company began upgrading its compressed-air system to air-cooled technology that not only saves energy, but provides heat that is reclaimed for space heating. The energy team is also exploring the installation of an energy-efficient HVAC system.

An organization with well-established and widely practised environmental values, S.C. Johnson continues to build on a record of success that includes numerous international awards for environmental leadership.

Seaman's Beverages Limited

Family-Owned Company

est. 1939
SEAMAN'S
Beverages
The Tradition
TOYOTA

Combines Commitment with Action

As one of Canada's few remaining family-owned, independent beverage companies, Seaman's Beverages Limited of Charlottetown, Prince Edward Island, can look far back into Canada's history. But when it comes to energy efficiency, the company looks toward the future.

Seaman's commitment to the environment is wide-reaching. The company has long sold its products in refillable containers, years before provincial law mandated the practice for environmental reasons. Thanks to its commitment to this program, Seaman's has achieved North America's highest return rate on bottles—97 percent—and reclaims 9 million aluminum bottle caps each year for recycling.

Within the company, there is an uncommon level of commitment to energy conservation, as employees actively participate with the company in efforts to reduce energy use and control costs. Thanks to employees' efforts, all vehicles are turned off when making deliveries. Delivery trucks are equipped with retread tires, and waste paper is collected, shredded and donated to a local animal shelter. Combining common sense with a zealous approach to managing its energy use, Seaman's installed motion-sensitive lighting throughout its production facility, ensuring that lights are on only in areas where people are working. To support a concern for PEI's environment that is shared by management and employees alike, the company regularly keeps everyone informed on energy and environmental issues.

Syncrude Canada Ltd.

New Technologies

Slash Energy Use at Syncrude Mine

Syncrude Canada Ltd.'s new Aurora mine, north of Fort McMurray, Alberta, is the first to combine the water-based transport of raw materials with low-energy bitumen extraction.

Departing from its historical use of draglines, bucketwheels and conveyor systems, the company has installed hydro-transport technology at the mine—a more efficient means of transporting oil sands for processing. Efficiency isn't the only benefit of the new technology. As an added bonus, bitumen begins to separate from sand while it is moving, enabling the use of lower temperatures during extraction. Hydro-transport has enabled Syncrude to install a new extraction process that operates at only 25°C (77°F)—40 percent lower than earlier methods. Although the energy-efficient new technologies at the mine will bring Syncrude major capital cost savings and long-term operating cost savings, the company is continuing its efforts to develop, refine and simplify processes to further reduce energy use.

The Aurora mine is an integral part of the company's $8.2 billion Syncrude 21 project, scheduled for completion by 2008. Syncrude 21 will see the investment of nearly $1 billion in new technologies and processes with direct environmental benefits.

SECTOR REPORTS

PROFILE: Canada's aluminum sector ranks fourth in the world in annual primary aluminum production. The combined output of the industry's 10 aluminum plants in Quebec and one in British Columbia is a major contributor to Canada's national and local economies. While production increases have forced the industry's total energy usage slightly upward, measurements of energy efficiency continue to demonstrate much improved performance compared with the benchmark 1990 levels.

ALUMINUM

PERFORMANCE HIGHLIGHTS

- **Canada's aluminum sector is the world's fourth largest in primary aluminum production.**
- **Energy represents about one third of the total production cost of primary aluminum.**
- **Energy efficiency is much improved over benchmark 1990 levels.**
- **Alcoa (Lauralco, Baie-Comeau and Aluminerie de Bécancour), Alcan and Aluminerie Alouette have all taken major steps to improve energy efficiency.**
- **At the end of 2000, the Government of Canada announced the creation of the Aluminum Research Institute with an investment of $47 million.**
- **Since 1990, the sector has reduced its CF_4 and C_2F_6 emissions by nearly 52 percent.**

ACTIONS Energy represents about one third of the total production cost of primary aluminum. This factor alone makes efficient energy management a prime objective for all smelters. Motivated by the need to control costs in an era of rising energy costs, sector members continue to actively pursue energy efficiency improvements.

For example, Alcan Aluminium Limited is seeking energy efficiency and greenhouse gas (GHG) emissions improvements from processes and auxiliary services. In 2000, the company shut down its old Soderberg Isle-Maligne smelter and initiated the progressive start-up of its new Alma smelter. Alma uses the most energy-efficient AP-30 Pechiney technology, which delivers an improvement of more than 20 percent in energy performance for electrolysis. Over the last 10 years, Alcan achieved significant reductions of anode effects, and consequently perfluorocarbon (PFC) emissions, in its smelters. Best practices are shared among the plants and, for that purpose, all smelters participated in an Alcan international symposium on anode-effects reduction at the end of 2000. Implementation of further reductions and improved control technologies are supported by Alcan research and development specialists.

Looking ahead, Alcan is establishing a new, long-term GHG-management program for all of its facilities. The TARGET program is designed to enable individual sites to develop appropriate programs leading to ongoing GHG-emissions reductions and will become an integral part of Alcan's business metrics and best practices.

Alcoa Inc. now owns three smelters in Quebec (Aluminerie Lauralco, Inc., Aluminerie de Bécancour Inc. and Aluminerie de Baie-Comeau). All of them are involved in energy conservation and GHG-emissions reduction projects. The strategy at Aluminerie Lauralco's Deschambault plant is to marry people and technology. Since 1993, for example, this strategy has led to a 90-percent reduction in GHGs from anode effects. In addition, a kaizen activity on the use of compressed air eliminated the operation of one of the plant's six compressors, leading to savings of about $500,000 per year. In 1999, Aluminerie de Bécancour Inc. launched projects to reduce natural gas and electricity consumption. The company is also evaluating the feasibility of other energy efficiency initiatives and continues to search for new energy, emissions and waste solutions. Aluminerie de Baie-Comeau improved the anode design in its prebake operation to reduce cell energy consumption and is undertaking several projects, including modernization of the pot-control equipment in its Soderberg operation, in an effort to reduce anode-effect frequency and PFC emissions. Within one of the CIPEC programs, the value analysis tool was used to identify energy reduction potentials in its cast house. Projects were ranked by merit, and the plant is now proceeding with process improvements.

Aluminerie Alouette Inc. completed a three-year cathode repair program in 1999. As a result of this and other process improvements, the company has slashed its energy consumption by more than 500 kWh/t of aluminum produced, a 3.8-percent decrease. Anode effects, the main PFC emissions source, were also cut by a factor of three. In total, the company reduced its energy consumption by 7 percent from 1995 to 2000 while, at the same time, increasing production by 12 percent. To further improve energy efficiency, the company has set its anode-effect frequency goal at zero.

At the end of 2000, the Government of Canada announced the creation of the Aluminium Research Institute with an investment of $47 million. One of the mandates of the institute will be to develop and improve technologies, from the production of primary aluminum to finished products. Technological breakthroughs are certainly possible. For example, Alcoa has announced that it is developing an inert anode which could be commercialized within the next five years. If such a product is brought to market, it will boost both the energy efficiency and production of the entire aluminum industry.

The Aluminium Association of Canada and Natural Resources Canada's Office of Energy Efficiency (OEE) have produced an energy efficiency guidebook for the aluminum sector entitled *Guide to Energy Efficiency in Aluminum Smelters*. The guide presents measures specific to melting furnaces in the aluminum sector. To obtain a free copy of the guide in English or French, fax the OEE at (613) 947-4121.

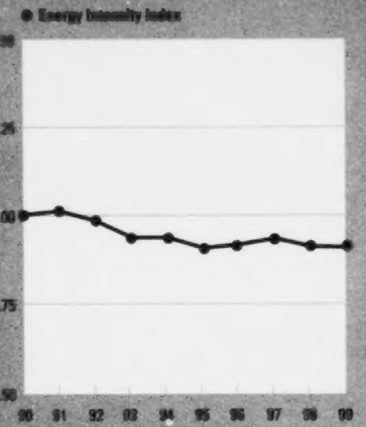
ACHIEVEMENTS For the aluminum industry, controlling anode effects, which increase energy consumption and produce GHGs, is critically important. A measurement program begun by the Canadian aluminum industry in 2000 reveals that a great deal of progress has been made. Primary aluminum production increased by 58 percent between 1990 and 1999, while GHG emissions remained stable. Over the same period, the sector reduced its GHG emissions per unit of production by more than 30 percent of carbon dioxide (CO_2) equivalent per tonne produced. Since 1990, the aluminum sector has reduced its emissions of tetrafluoroethane (CF_4) and hexafluoroethane (C_2F_6) by approximately 50 percent.

In the continuing quest for greater efficiency and better conductivity, the industry is moving to replace less efficient amorphous carbon cathode blocks with graphitized blocks. Although more expensive, graphitized blocks allow plants to boost reduction pot amperage without increasing voltage, thus producing more aluminum with each kilowatt of electricity. Several Canadian smelters operating modern prebake technology have already switched to graphitized blocks. This measure, combined with other process control improvements, enables an energy utilization factor of over 98 percent – a performance unmatched by other industries.

To further the cause of energy efficiency, the sector has established aluminum recycling as an industry-wide priority. Aluminum is fully recyclable, and turning scrap into useful metal requires only 5 percent of the energy consumed in the production of primary aluminum. Improvements in recycling rates will not only divert aluminum from the waste stream, they will also improve the sector's overall energy intensity.

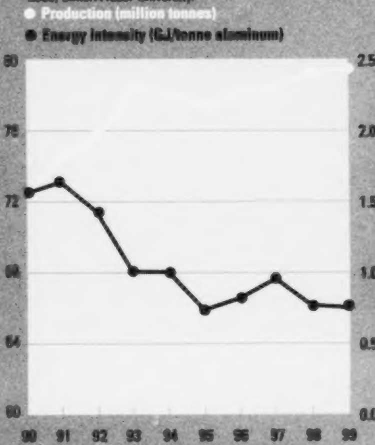
CHALLENGES While the industry will continue to make small energy efficiency gains through enhanced processes, the most significant improvements will come from the construction of new, state-of-the-art smelters. Such a transformation requires large capital investments and the availability of large quantities of electricity at highly competitive prices. Modern facilities currently account for 72 percent of total aluminum production. However, low aluminum prices combined with high energy costs will challenge the industry's ability to generate the funds needed to finance these investments. Developing workable economic models for the continued development of new facilities remains a significant industry challenge.

Aluminum Sector SIC 2951
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



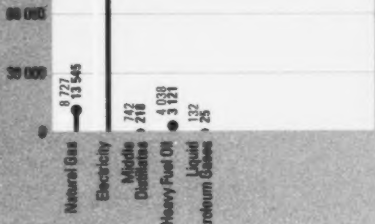
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre. *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.

Aluminum Sector SIC 2951
Energy Intensity and Physical Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre. *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.

Aluminum Sector SIC 2951
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre. *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE Brewing in Canada is a diverse and modern industry actively pursuing ambitious energy efficiency targets. The industry is made up of two national brewing companies, several regional brewers and numerous microbreweries. Together, these establishments – which employ nearly 17 000 workers in 76 breweries across Canada – produced about 23 million hectolitres of beer in 1999.

BREWERY

PERFORMANCE HIGHLIGHTS

- **The brewery sector employs nearly 17 000 workers in 76 breweries across Canada.**
- **Enhanced monitoring and control equipment, maintenance and procedures have enabled brewers to identify and implement energy-saving measures.**
- **Despite several years of stable production, Canada's brewing industry continues to trim the amount of fuel and electricity it consumes.**
- **Compared to 1995, the industry has reduced its energy consumption by 5.4 percent per hectolitre of beer produced.**
- **The industry remains committed to an annual energy reduction of 1.0 percent over the next two years and, beginning in 2004, 1.5 percent annually through 2006.**

ACTIONS In 1999, Canada's brewers continued to invest in efforts to improve energy efficiency. These measures included significant capital investments, maintenance (housekeeping) improvements and energy-management initiatives. Capital investments included major upgrades to powerhouse equipment. They also encompassed improvements to beer process and packaging facilities, including the installation of power-saving variable frequency drives on electrical motors, more efficient electrical-energy conditioning equipment, energy-efficient lighting and high-efficiency boilers. Steam ejectors were replaced with energy-efficient vacuum pumps, and improved cooler doors were installed in carbonating systems.

Enhanced maintenance, monitoring and control equipment procedures also have enabled brewers to identify opportunities for improvement and implement energy-saving measures. Activities included the following:

- the installation of a digital demand/consumption meter to provide instantaneous monitoring of demand/consumption rates;
- the improvement of post-run shutdown procedures to avoid energy waste;
- the upgrading of ammonia suction pressure control on refrigeration systems;
- the tuning of capacitor banks to increase the power factor;
- the reduction of lighting and the shutdown of ventilation;
- the optimization of a glycol cooler to improve heat transfer efficiency and defrosting; and
- the continuing use of an ultrasonic steam trap inspector to identify faulty traps.

Energy audits and energy accountability help focus employees on energy waste reduction and energy conservation opportunities. Meeting on a regular basis, energy committees of managers, technical support staff and workers at the plant level have been responsible for the incremental energy improvements in all functional areas. The benchmarking of energy and water usage performance, on a company basis and among breweries internationally, helped identify best practices and opportunities to reduce energy consumption in brewing operations. Some breweries undertake powerhouse audits on a weekly basis.

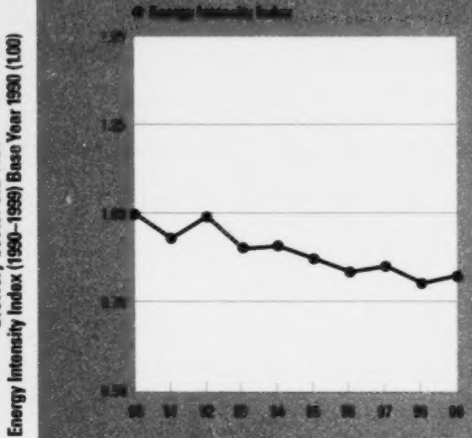
Energy Efficiency Opportunities in the Canadian Brewing Industry, which was released in November 1998 with Natural Resources Canada's support, remains an excellent reference for individual energy efficiency action plans and furthers the sector's energy-reduction performance. Developed through the Brewers Association of Canada's Environment Committee, the guide highlights a vast array of energy-saving opportunities and identifies ways that energy efficiency activities can reduce costs within a brewery. The guide demonstrates the industry's commitment to the reduction of greenhouse gases in support of the Government of Canada's environmental objectives and international undertakings.

ACHIEVEMENTS Despite several years of stable production, Canada's brewing industry continues to trim the amount of fuel and electricity it consumes. Compared to 1995, the industry now uses 5.4 percent less energy to produce a hectolitre of beer. In 1999 the industry consumed 5995 TJ of energy, 73 percent of which was natural gas, 6 percent fuel oil and 21 percent electricity.

The brewing industry is committed to an energy-reduction target of 1.0 percent per year over the next two years and, beginning in 2004, 1.5 percent annually through 2006.

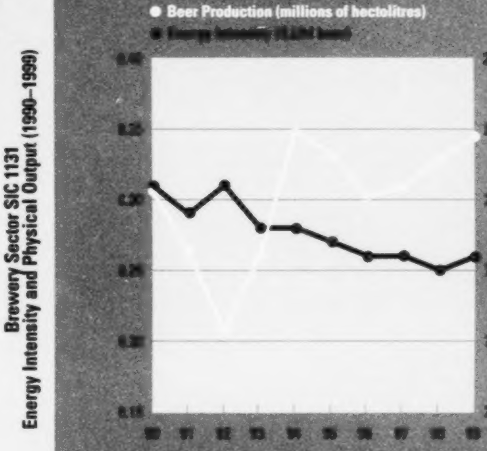
CHALLENGES Cost control is a priority for the brewing industry. Flat sales since about 1975, greater competition from foreign brewers, increased competition from products such as coolers and growth in non-taxed alternatives (such as beer produced from kits and at "u-brews") have combined to weaken sales.

Brewers have responded to these challenges by developing export strategies that make Canada one of the top beer exporters in the world. Canada's brewers have also negotiated agreements that enable them to produce a number of products in Canada that would otherwise be imported. More than 400 distinct brands are now available in the Canadian market, from traditional ales and lagers to new products with varying strengths of alcohol, flavours and textures. Clearly, the industry is well positioned to meet its competition head-on. Product and marketing innovations notwithstanding, energy remains a substantial cost component in the brewing process, especially with recently escalating energy prices. Finding ways to improve energy efficiency is, therefore, a priority for Canada's brewers.



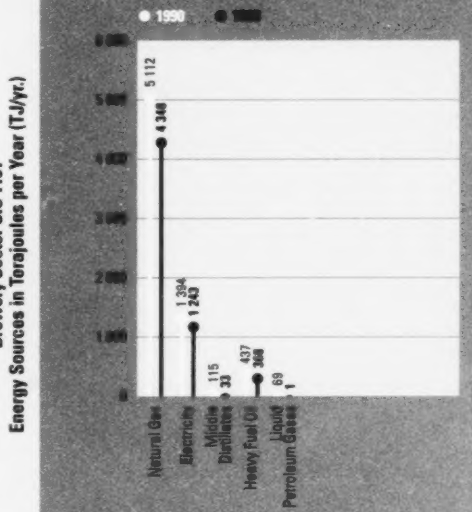
Brewery Sector SIC 1131
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.



Brewery Sector SIC 1131
Energy Intensity and Physical Output (1990–1999)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.



Brewery Sector SIC 1131
Energy Sources in Terajoules per Year (TJ/yr.)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE The cement industry is the cornerstone of Canada's domestic construction industries and a significant exporter that contributes substantially to the country's balance of payments. The industry's nine companies, which operate 16 manufacturing facilities with a combined production capacity of 12.6 million tonnes of clinker, increased their shipments by 4.5 percent in 1999.

CEMENT

PERFORMANCE HIGHLIGHTS

- **The cement sector saw a 4.5-percent increase in shipments in 1999.**
- **Essroc Canada is planning to use scrap tires as a source of fuel, thereby reducing its coal consumption by as much as 20 percent.**
- **Lafarge Canada's Saint-Constant plant is now substituting 20 percent of its fossil fuel usage with scrap tires.**
- **An energy-saving pneumatic kiln feed system and a five-stage single string preheater at Lafarge Canada's Richmond plant uses a low-NO_2 inline calciner and downdraft calciner to ensure environmentally sound pyroprocessing.**
- **St. Lawrence Cement has teamed up with Algoma Steel to produce high-quality slag for use in concrete production.**
- **The Cement Association of Canada estimates that, by the end of 2000, total emissions associated with domestic cement consumption will be 6 percent below 1990 levels.**

ACTIONS Cement manufacturers continue to implement energy efficiency projects. For example, at its Picton, Ontario, facility, Essroc Canada Inc. has established a closed-loop system which uses an on-site quarry to recycle process water. In addition, Essroc is planning to use as many as 1.6 million scrap rubber tires annually to fuel its preheater kiln, saving up to 20 000 tonnes of fossil fuels each year. When implemented, the program will divert as many as one third of the tires currently going to dumps in Ontario each year and replace up to 20 percent of the coal burned at the plant. In addition, Essroc increased feed residence times in the preheater cyclones and installed additional heat exchange chains, resulting in further fuel savings.

In addition to a new, energy-efficient dry kiln now in operation at Lafarge Canada Inc.'s Richmond, British Columbia, plant, the company is employing an energy-saving pneumatic kiln feed system. The system connects the blending silo to a five-stage single string preheater, which uses a low-NO_2 inline calciner and downdraft calciner to ensure environmentally sound pyroprocessing. Lafarge Canada Inc. has also commissioned a second scrap tire injector in the second kiln at its Saint-Constant, Quebec, plant, which will bring the total fuel substitution ratio to 20 percent.

St. Lawrence Cement Inc. has joined forces with Algoma Steel Inc. to open a slag granulator at Algoma's Sault Ste. Marie, Ontario, plant. Built by St. Lawrence Cement, the granulator is expected to produce 455 000 tonnes of granulated blast furnace slag each year, which St. Lawrence Cement will use as a high-quality component in its concrete. Granulated slag enables the production of easier-to-work-with, more durable concrete with a higher resistance to chemicals. The joint project provides significant environmental gains for both companies and is consistent with St. Lawrence Cement's emphasis on the use of renewable and waste sources of energy to produce its products.

The cement sector is also actively promoting energy issues through its industry association. The industry participates in the "Building Industry Table" and holds regular environmental committee meetings. The Cement Association of Canada is also actively involved in collecting information related to energy savings, emissions and the energy-efficient application of its products.

ACHIEVEMENTS Canada's cement sector has reduced it fuel consumption by an impressive 30 percent per tonne since the mid-1970s, principally by implementing major process improvements. The Cement Association of Canada estimates that, by the end of 2000, total emissions associated with domestic cement consumption will be 6 percent below 1990 levels. This projection is based on an estimated 12-percent increase in domestic consumption between 1997 and 2000. Associated emissions per tonne of concrete product should show a 14-percent decrease in CO_2 compared with 1990.

The principal energy sources used for cement production are coal, natural gas and petroleum coke. In 1999, the use of alternative fuels (tires, wood waste, used oils and waste fuel) increased to 6003 terajoules, or 8.8 percent of total energy used. Manufacturers continue to improve environmental performance through the use of waste materials and fuels in the production process.

Since 1990, the cement sector has managed to reduce its combined energy intensity by 4 percent, despite a production increase of more than 20 percent. The expanded use of power monitoring, targeting and other systems and technologies will combine with plant modernizations to further energy efficiency improvements within the sector.

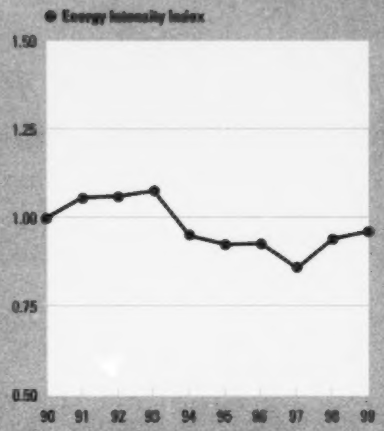
CHALLENGES The cement sector is currently reconstituting its CIPEC Task Force, thereby delaying joint progress toward sectoral goals. Moreover, since energy consumption is a competitive issue, sector companies treat energy cost reduction information as confidential, inhibiting broad information sharing. Energy is a substantial cost component in the production of cement, and energy efficiency gains can improve a company's competitive position in the marketplace.

The cement sector's energy intensity target is an improvement of 0.5 percent per year through the year 2000. Reaching this goal depends on continued strong demand for the industry's products, along with the acceptance of standard methods for measuring waste fuel efficiencies and energy embodied in its exports.

These conditions are far from assured. For example, long-standing discussions among waste producers and waste users have not yet yielded an appropriate methodology to establish emissions-related credits for waste material use in the production of cement. Similarly, complex international negotiations continue to delay the establishment of standardized accounting methods for energy embodied in cement exports. Moreover, the potential implementation of economic instruments such as a "carbon tax" could seriously impair Canada's cement exports.

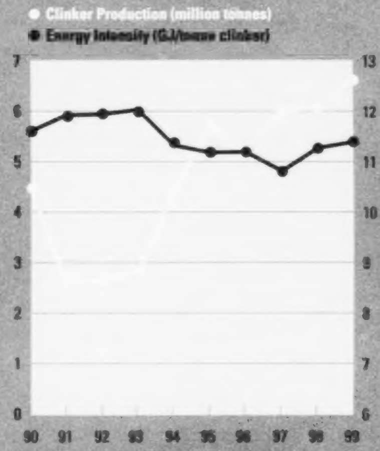
Many cement producers would gladly expand the use of waste materials such as discarded tires as fuel. However, low landfill fees for discarded tires in many jurisdictions inhibit such use. Despite the obstacles, the industry continues to promote concrete as an energy-efficient product and to make cement and concrete the materials of choice for environmentally responsible industries. It is also continuing to develop an appropriate methodology for life-cycle assessment of cement-based materials and products.

Cement Sector SIC 3521
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



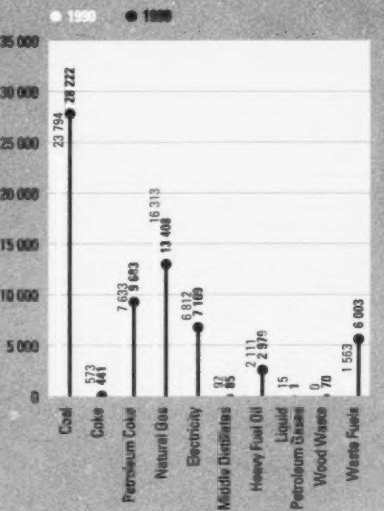
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 2001. Simon Fraser University.

Cement Sector SIC 3521
Energy Intensity and Physical Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 2001.

Cement Sector SIC 3521
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 2001. Simon Fraser University.

PROFILE: The chemical sector is a diverse industry producing organic and inorganic chemicals, as well as plastics and synthetic resins. Companies in this sector operate 775 facilities Canada-wide, directly employing more than 24 000 people with an annual payroll of $1.3 billion.

CHEMICAL

PERFORMANCE HIGHLIGHTS

- The chemical sector operates 775 facilities Canada-wide, directly employing more than 24 000 people.
- NOVA Chemicals' new Joffre cogeneration plant now produces 4 percent of Alberta's electrical power.
- An N_2O abatement facility at DuPont's Maitland, Ontario, site has exceeded target performance for 1999, generating a CO_2 reduction of 10.3 million tonnes.
- Sterling Pulp has slashed oil consumption by 88 percent at its Buckingham, Quebec, facility by recovering and using waste hydrogen.
- The global warming potential per unit of output in the sector has decreased by 50 percent.

ACTIONS The chemical sector continued to take bold action to improve energy efficiency in 1999. A major component in the sector's ability to improve performance is cogeneration. In aggregate, Canadian Chemical Producers' Association (CCPA) members accounting for 82 percent of the sector's CO_2 emissions are now meeting 49 percent of electricity and 44 percent of steam requirements through cogeneration. By 2010, cogeneration is expected to account for 78 percent of electricity and 67 percent of steam required.

All CCPA member companies must subscribe to the association's Responsible Care® initiative. Responsible Care establishes guiding principles and codes of practice covering all aspects of the chemical life cycle, including the requirement that each member report annually on the emissions of as many as 500 substances.

Individual manufacturers have taken noteworthy action in 1999. Following are some examples.

At the company's St. Clair River and Moore Township plants in Ontario, NOVA Chemicals Corporation has upgraded processes, reduced bottlenecks and minimized downtime as part of its 10-year Total Energy Reduction Program. The plants reduced line restrictions by replacing control valves with variable frequency drivers on some pumps, increased line sizes and reduced pressures to increase system flow rates. A new vessel cut steam use while an increased reactor length on one line led to a large improvement in product output. Employees worked together to minimize downtime and keep the processes running. The efforts paid off. Energy use was cut by 27 percent at the St. Clair River plant and by 32 percent at the Moore facility. Since 1990, the two plants have cut annual energy use by the equivalent of 2.5 million gallons of gasoline.

At its Joffre, Alberta, plant, NOVA Chemicals' new cogeneration power plant is now in operation. The $380-million plant supplies the electrical needs of the newly expanded plant and provides approximately 330 megawatts of excess power to the Alberta Interconnected System. A partnership with ATCO Power, the plant increases the amount of energy generated in Alberta by more than 4 percent.

In Buckingham, Quebec, Sterling Pulp Chemicals Ltd. has begun to capture waste hydrogen from its processing for use as a fuel. Sterling Pulp has invested more than $800,000 in the hydrogen project, which has enabled the company to replace oil with a clean-burning, greenhouse gas (GHG) free alternative in the production of sodium chlorate and sodium chlorite. By capturing and using hydrogen, Sterling Pulp has slashed oil consumption from 6.9 million litres in 1995 to 0.9 million litres in 1999, an 88-percent reduction in fossil fuel use. Moreover, compared to 1998, CO_2 emissions from the site have been cut by 70 percent, and oxides of nitrogen and sulphur emissions have been reduced.

A nitrous oxide (N_2O) abatement facility at the Maitland, Ontario, site of DuPont Canada Inc. has exceeded target performance for 1999, thereby accelerating the rate of improvement of this new technology since its launch in 1997. The facility's exceptional performance has led to actual N_2O abatement of 85.5 percent in 1999 compared to a target of 75.0 percent. The improvement is equivalent to a CO_2 reduction of 10.3 million tonnes.

ACHIEVEMENTS

In 1999 the chemical sector's energy consumption totalled 218 427 TJ, a 22-percent increase over 1992 levels. However, the constant dollar value of the industry's products, used as a measure of output, increased 26 percent over the same period and 1 percent from 1998 to 1999. During the same period, CO_2 emissions levels increased 4.6 percent, and CO_2 emissions per unit of output decreased 17 percent. Total GHG emissions in 1999, expressed as CO_2 equivalents, decreased 37 percent from 1992 levels. GHG emissions per unit of output decreased 50 percent. The CCPA estimates that, in 2004, CO_2 and GHG emissions per unit of output will be 33 percent and 58 percent, respectively, lower than 1992 emissions.

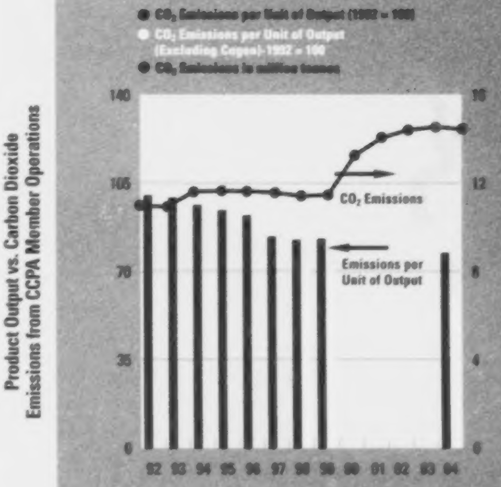
In 1999, CCPA established the world's first protocol for re-verification of Responsible Care companies. Responsible Care is an industry-wide program aimed at continuing improvement in the industry's environmental performance. Although the new protocol was put into place in June 1999, by year-end five companies completed their re-verifications with another 20 or more underway. Late in 2000, CCPA's exceptional commitment to environmental issues through Responsible Care earned the association Gold Level Champion Reporter status from Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) for its action plan to reduce GHG emissions.

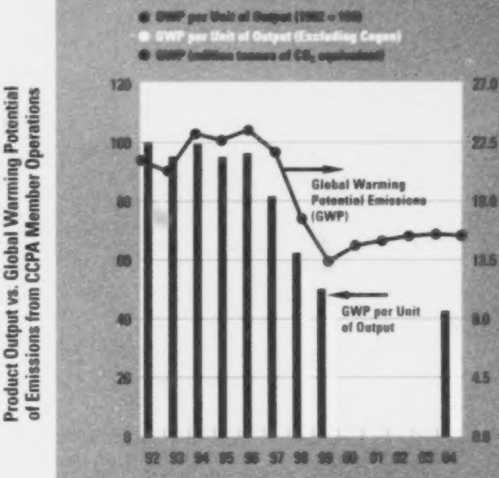
Under Responsible Care, all top CO_2 emitters are expected to register with VCR Inc. In aggregate, these members account for over 90 percent of all CO_2 emitted by CCPA members. For more information about climate change and the chemical industry, visit the CCPA Web site at www.ccpa.ca.

CHALLENGES

Obtaining accurate information remains an issue for the chemical sector. The creation of data is complicated by the chemical industry's use of natural gas and petroleum distillates as feedstock as well as fuel. To ensure accurate and consistent reporting of energy consumption, the CCPA is working with several government agencies on ways to improve the sector's energy consumption measurement and reporting.

Continued growth in the chemical industry makes it likely that, while CO_2 emissions per unit of output will continue to improve, total CO_2 emissions will grow. The dramatic changes already made through application of cogeneration and nitrous oxide abatement technologies will be difficult to replicate. However, the globally competitive nature of the chemical industry will maintain the incentive to continually improve energy efficiency.





Footnotes:

1. Chemical output and emission forecasts take into account announced capacity increases.

2. Historical output was calculated using constant 1992 dollars, taking into account average chemical pricing changes.

PROFILE: Canada's dairy product manufacturing sector spans the country from coast to coast. Employing 20 500 people in more than 270 facilities, Canada's dairies processed more than 73 million hectolitres of raw milk and shipped an estimated $8.6 billion worth of milk products in 1999.

DAIRY

PERFORMANCE HIGHLIGHTS

- Canada's dairies shipped products worth an estimated $8.6 billion in 1999.
- Dairies have implemented dozens of energy-saving process improvements, from thermal storage of recovered hot water to exterior tanker recycled water washes, lighting upgrades and improved control of air and water leakage.
- Dairies employ electrical, thermal and water-based energy systems in their facilities.
- Agropur Coopérative Agro-Alimentaire uses energy-saving anaerobic technology for treating waste-water at its cheddar cheese facility.
- Foothills Creamery has installed high-efficiency lighting and ballasts along with motion sensors in its plant.
- The National Dairy Council of Canada released its study, *Energy Performance Indicator Report – Fluid Milk Plants.*
- In 1999, the sector's total energy consumption was 12 846 TJ, up slightly from the 1990 level of 11 952 TJ.
- The sector's energy intensity is increasing due to consumer demand for products which require more energy to produce.

ACTIONS Energy is a key component in milk processing. Typically, dairies employ electrical, thermal and water-based energy systems in their facilities for such processes as pasteurization, churning, washing, packaging, cooling, freezing and drying. The importance of energy to the sector has led the National Dairy Council of Canada to promote industry-wide participation in energy efficiency efforts.

The Council encourages each dairy industry subsector to implement low-cost, no-cost and retrofit improvements throughout their plant operations. Dairies have implemented dozens of energy-saving process improvements, from the thermal storage of recovered hot water to exterior tanker recycled water washes, lighting upgrades and improved control of air and water leakage.

For example, Agropur Coopérative Agro-Alimentaire's cheddar cheese facility in Notre-Dame-du-Bon-Conseil, Quebec, uses leading-edge technological innovations to foster energy efficiency in its waste-water treatment plant. The plant uses an anaerobic treatment system which saves $100,000 in annual energy costs, cuts sludge by 90 percent and generates about $50,000 in usable methane. The company recently installed a Sequential Batch Reactor (SBR), saving 30 percent on energy used for lagoon aeration, and added a high-efficiency air diffuser.

Foothills Creamery Ltd., in Edmonton, Alberta, has installed high-efficiency lighting and ballasts throughout its plant, adding motion sensors in its warehouse, cooler and freezer areas. The sensors shut off lighting when the areas are not in use. The lighting retrofit is saving the company more than $11,000 per year and is delivering a return on investment of 58 percent.

The Dairy Sector Task Force provides companies seeking to make such improvements with information on expected cost savings and payback periods. Moreover, the National Dairy Council of Canada, in partnership with Natural Resources Canada, supports the energy efficiency achievements of dairy plant managers through research and educational materials.

In 2000, the National Dairy Council of Canada released a study entitled *Energy Performance Indicator Report – Fluid Milk Plants.* The study develops benchmarks for energy efficiency in Canadian fluid milk plants and establishes a methodology appropriate for examining plant energy performance. The study also reviews potential energy-saving ideas appropriate for the milk processing industry.

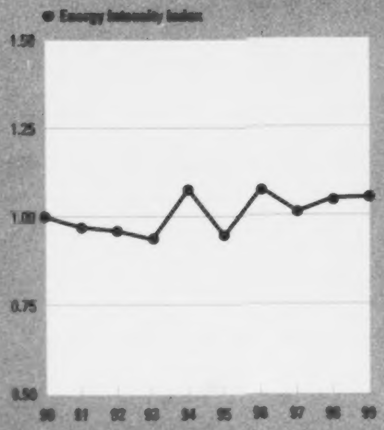
ACHIEVEMENTS The dairy sector has made significant progress toward lowering its costs through improved energy efficiency. In 1999, the dairy product manufacturing sector's total energy consumption was 12 846 TJ, up slightly from the 1990 level of 11 952 TJ. The amount of milk and cream produced in 1999 is also up from 1990 levels. Except for a peak year in 1994, energy intensity remained at or below the 1990 level until 1996 when consumer demand for more energy-intensive products from the industry offset the sector's progress in improving energy efficiency.

CHALLENGES With rapidly rising energy prices and limited availability of capital, improving energy efficiency is a significant challenge for dairy product manufacturers. In addition, rationalization and competitive pressures continue to drive the industry to reduce excess capacity in the face of static sales.

While the sector's main source of raw milk is highly regulated, the marketplace demands that dairy product companies provide innovative, high-quality, value-added products at the best possible prices. Unfortunately, creating the products consumers want often conflicts with efforts to improve energy efficiency. For example, producing increasingly popular extended-shelf-life products requires ultra-high-temperature pasteurization and other processes which use significantly more energy per unit of output.

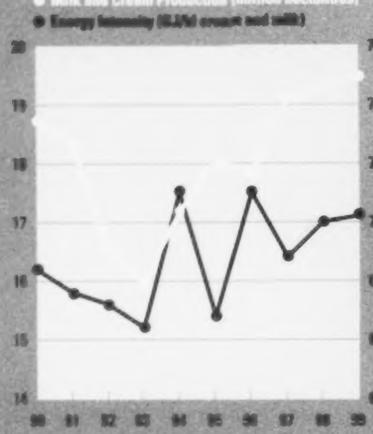
Manufacturers have already made the most of the low-cost and no-cost energy efficiency improvements available to them. Their greatest challenge going forward is to make the more costly, payback-delayed improvements which will further advance energy efficiency.

Dairy Sector SIC 104
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



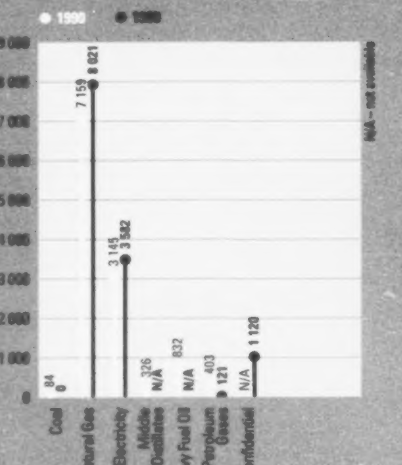
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Dairy Sector SIC 104
Energy Intensity and Physical Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Dairy Sector SIC 104
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE The electrical and electronics sector includes a diverse array of companies that produce electrical appliances, lighting, consumer electronics, communications and electronic equipment, cabling, office equipment, industrial equipment and other electrical products. These companies operate more than 1400 facilities employing over 119 600 workers across Canada. The industry is a major exporter and a vital, growing contributor to the national economy.

ELECTRICAL AND ELECTRONICS

PERFORMANCE HIGHLIGHTS

- **The electrical and electronics sector is Canada's least energy-intensive industry.**
- **IBM Canada initiated 18 separate energy-conservation projects in 1999/2000.**
- **Honeywell employees who do not need a permanent office location are being encouraged to work from home offices.**
- **Ascolectric Ltd. installed a closed-loop cooling system, enabling the company to cut water use by two thirds.**
- **Average energy expenditures are less than 1 percent of the value of the industry's shipments, compared with more than 61 percent for materials and supplies and 16 percent for labour.**
- **Between 1990 and the end of 1999, the sector's energy consumption remained relatively constant despite substantial growth in production.**
- **The industry projects a decrease of one third in energy consumption over the next decade, ahead of its Kyoto commitments.**
- **Many sector manufacturers make a significant contribution to decreasing CO_2 emissions by increasing the energy efficiency of the products they manufacture and sell.**

ACTIONS Although the electrical and electronics sector is one of Canada's least energy-intensive industries, many corporations remain committed to environmental programs and sustainable development and continue to include energy efficiency as a vital component of their efforts to control costs. Following are some examples.

By the end of 2000, IBM Canada Ltd. initiated 18 separate energy-conservation projects, as well as the systematic rationalization of IBM mainframe computer technology, from water-cooled processors to new air-cooled CMOS machines. At the company's National Distribution Centre in Markham, Ontario, IBM implemented initiatives to eliminate the conveyor system, reduce compressor use and delamp high-intensity discharge (HID) lights in double-lit areas in the warehouse. The company installed lighting timers and automatic curtains for a controlled-humidity environment and retrofitted steam electrode humidifiers for warehouse unit heaters to ultrasonic electric humidifiers and programmable thermostats. IBM conducted a lamp and ballast retrofit in its office tower and warehouse offices, installed a programmable low-voltage lighting-control system with zonal control in warehouse modules and fitted occupancy sensors in small rooms, meeting rooms, washrooms and high-bay warehouse buildings. The company established new building automation system monitoring points and even enhanced the efficiency of the vending machines through the installation of power optimization controllers.

Honeywell Limited has a 15-percent energy-reduction target. The company's Scarborough, Ontario, Manufacturing Operations and its Vancouver, British Columbia, Honeywell-Measurex facility, have identified opportunities to reduce energy consumption by installing improved heating, ventilating and air-conditioning (HVAC) controls and lighting controllers to turn off lights when buildings are unoccupied. Modification helped the Scarborough facility to achieve a 6-percent energy reduction in 1999 over 1998. To further reduce company-wide energy usage, many under-utilized offices are being closed and people relocated to newer, more energy-efficient buildings. Employees who do not need a permanent office location, such as sales and field operations people, are being encouraged to create home offices as a basis of operations.

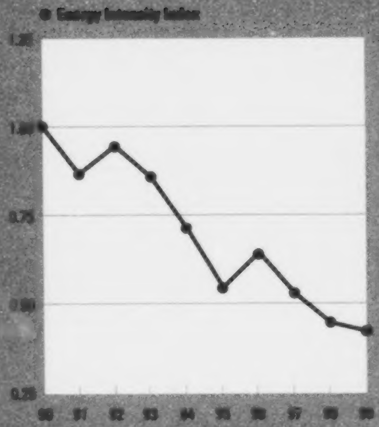
Ascolectric Ltd. installed a closed-loop cooling system, enabling the company to cut water use by two thirds at its Brantford, Ontario, facility. Ascolectric is always looking for ways to increase efficiency. The company insulated plant windows with plastic barriers that keep the heat out in summer and the cold out in winter. The plant installed buffers in its shipping and receiving doors to reduce leaks and drafts when trucks load and unload. The company has seen a decrease in natural gas consumption with the introduction of these simple energy initiatives.

ACHIEVEMENTS Between 1990 and 1999, the electrical and electronics sector's gross domestic product (GDP) increased by 57.8 percent. In 1999, the industry consumed 18 367 TJ of energy, representing 0.71 percent of the energy consumed by the manufacturing sector as a whole, and 0.53 percent of total energy-related manufacturing CO_2 emissions. On average, expenditures on energy are equivalent to less than 1 percent of the value of the industry's shipments, compared with more than 61 percent for materials and supplies and 16 percent for labour. Natural gas and electricity satisfy virtually all of the industry's energy requirements.

Between 1990 and the end of 1999, the sector's energy consumption remained relatively constant despite substantial growth in production. These factors have combined to decrease energy intensity by 57.85 percent. The consolidation of manufacturing operations and distribution channels (through acquisitions and mergers) is bringing the industry increased efficiencies of scale, which could lead to a projected decrease in energy consumption of one third over the next decade. Despite the challenges it faces, the electrical and electronics sector is ahead of its Kyoto commitment.

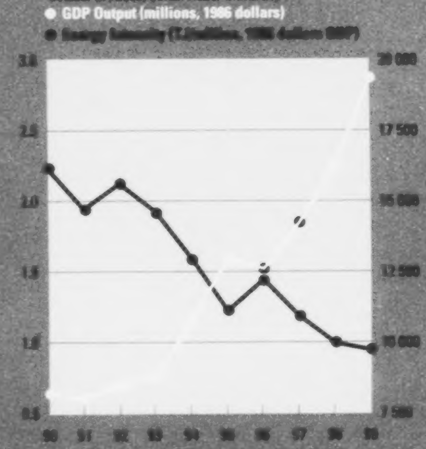
Many of the sector's manufacturers make a significant contribution to decreasing CO_2 emissions through the products they manufacture and sell. Products ranging from oil refinery control systems to high-efficiency motors and lighting are used directly by other companies to decrease their energy consumption.

CHALLENGES Because the electrical and electronics sector is not energy intensive, many manufacturers consider greenhouse gas (GHG) emissions and energy efficiency less critical to the industry's health than technological change, market growth and sales and distribution issues. Manufacturers often fear that unilateral Canadian actions to reduce GHG emissions in response to the Kyoto commitment place their plants at a competitive disadvantage with foreign-based competitors with fewer environmental constraints. To most companies, with a primary focus on the next two fiscal quarters, a commitment to long-term targets appears unrealistic.



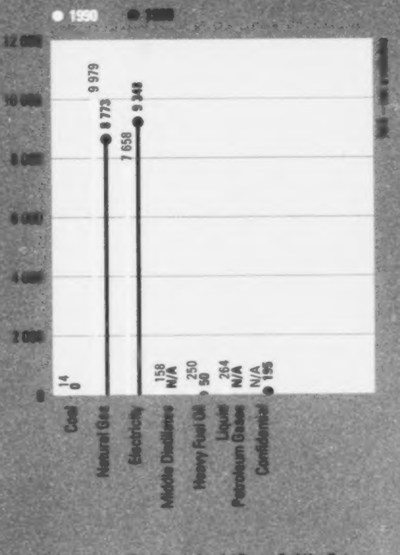
Electrical and Electronics Sector SIC 33
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.



Electrical and Electronics Sector SIC 33
Energy Intensity and Economic Output (1990–1999)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.



Electrical and Electronics Sector SIC 33
Energy Sources in Terajoules per Year (TJ/yr.)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE: Canada's fertilizer industry is one of the world's major producers and exporters of nitrogen, potash and sulphur fertilizers, manufacturing 12 percent of the world's total fertilizer materials. Companies in this sector operate more than 30 production facilities.

FERTILIZER

PERFORMANCE HIGHLIGHTS

- **Canada's fertilizer industry is one of the world's major producers and exporters of nitrogen, potash and sulphur fertilizers.**
- **The Canadian industry is among the most energy efficient compared with its global competitors.**
- **The Canadian Fertilizer Institute and its partners are conducting research on GHG emissions from agroecosystems using varying applications of fertilizer.**
- **The industry's domestic agriculture sales total about $2 billion annually, supporting a network of more than 1500 distributors and retailers across the country.**
- **Total Canadian shipments are approximately 24 million tonnes, valued at approximately $5.5 billion.**
- **Nitrogen fertilizer production increased from 6.8 million tonnes in 1990 to 10.3 million tonnes in 1999.**

ACTIONS The Fertilizer Sector Task Force continues to develop baseline information on the sector's energy use and to resolve data issues surrounding the use of natural gas as a feedstock in the production of nitrogen fertilizers. This process will enable the sector to better measure energy-use patterns and monitor energy efficiency improvements. In addition, the Canadian Fertilizer Institute (CFI) in partnership with Agriculture and Agri-Food Canada and the University of Manitoba are conducting research to determine greenhouse gas (GHG) emissions from agroecosystems under varying regimes of nitrogenous fertilizer application.

While fertilizer manufacturers regard information on their specific energy efficiency activities as confidential, it is clear that the Canadian fertilizer industry is among the most energy efficient in the world. Moreover, economic and environmental factors are leading companies in the sector to continue to develop and employ energy-efficient new technologies. The intensifying international focus on climate change provides additional impetus to improve energy intensity and limit GHG emissions.

ACHIEVEMENTS Canada's fertilizer industry records total annual shipments of approximately 24 million tonnes, valued at about $5.5 billion. More than 75 percent of these shipments are exported, with two thirds of exports to U.S. farmers. Domestically, agriculture sales total about $2 billion annually. The manufacture, distribution and sales of fertilizer products employ about 12 000 people from coast to coast, including a nationwide domestic network that exceeds 1500 distributors and retailers.

Canadian fertilizer manufacturers are acknowledged world leaders in sectoral energy efficiency and emissions control. The industry's success in reducing energy intensity is a major factor in its ability to remain internationally competitive.

Fertilizer production is energy intensive, making energy efficiency a key industry priority. Most of the natural gas consumed by the sector is used as a feedstock to generate hydrogen, an essential ingredient in the production of ammonia. Production efficiency, particularly of nitrogenous fertilizers, has improved over the last 10 years. When natural gas consumption rises, as it has in recent years, it largely reflects increases in the volume of fertilizer produced and exported.

Since 1990, potash production has increased 19.18 percent for a total of 8 329 890 tonnes in 1999. Based on Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) data, over the same period energy consumption by potash producers has risen, but the energy component per tonne has declined from 3.92 GJ per tonne in 1990 to 3.89 GJ per tonne of output in 1999. Overall, energy indicators show an improvement in energy intensity that averages more than 1 percent per year since 1990.

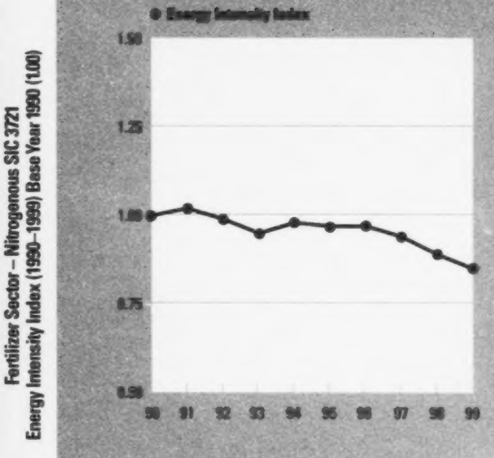
According to CIEEDAC, nitrogen fertilizer production increased from 5.44 million tonnes in 1990 to 5 941 613 tonnes in 1999, while the Fertilizer Sector Task Force database shows production totals of 6 815 742 tonnes for 1990 and 10 267 296 tonnes for 1999. Similarly, the CFI reports 1999 natural gas consumption at 46 452 TJ versus 37 192 TJ in 1990. Other energy consumed was 6108 TJ in 1999, compared with 3830 TJ in 1990. CFI numbers have been used for natural gas consumption, because the task force believes that CIEEDAC surveys may include natural gas used as a feedstock (normally about 70 percent of the natural gas consumed in ammonia production) in its energy consumption data. The 1999 figures prepared by the task force, and accepted by Natural Resources Canada, show energy intensity and production based on a data quality analysis conducted to reconcile these differences.

(Note: The figures used for the graphs in this section are derived from data developed by CIPEC's task force for nitrogenous fertilizers only.)

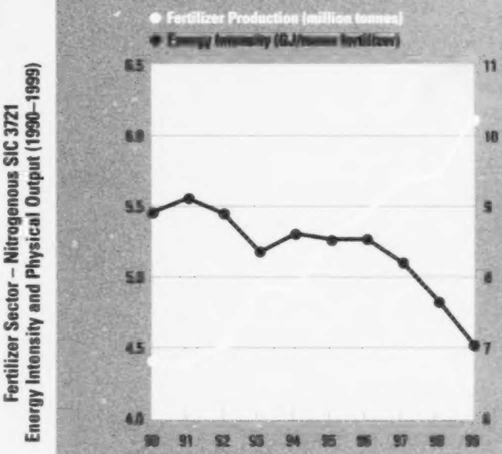
CHALLENGES Fertilizers play an important role in maintaining and restoring atmospheric health. Just as animals, humans and human technological activities consume oxygen and release CO_2, plants absorb CO_2 and release oxygen. When in harmony, these forces create a stable, but delicate, balance of gases in the atmosphere. By increasing the plant biomass that absorbs CO_2 and produces oxygen, fertilizers help to reinforce the natural balance. Recognizing the important environmental role the industry plays, the CFI has embarked on collaborative research to identify agricultural practices that maximize CO_2 removal from the atmosphere.

The fertilizer industry faces a significant global challenge. Rapid world population growth combined with limited and diminishing productive crop land is taxing humanity's ability to produce enough food to improve the diets of a growing worldwide population. For the agricultural industry to sustain and boost its production, high-yield practices must be embraced. Consequently, the fertilizer industry must be prepared to make a vital contribution to the sustainability of global food production by focusing on the responsible production and use of fertilizer to nourish the world's soil.

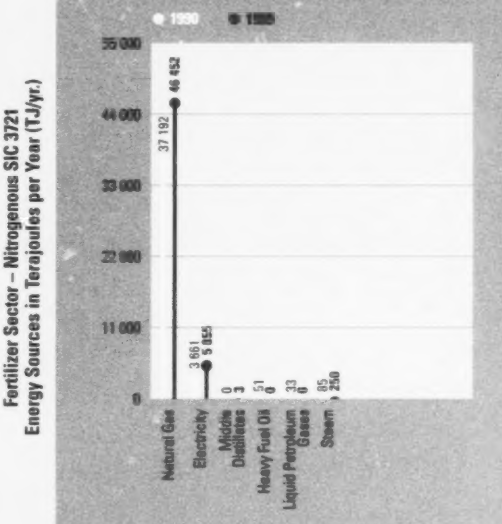
This challenge has been made more complex by the impact of rising world energy prices. Towards the end of 2000, dramatic increases in the price of natural gas contributed to substantially reduced production of nitrogenous fertilizers throughout North America, a trend that may threaten food production in the coming years.



Data source: Canadian Fertilizer Institute (CFI), February 15, 2001.



Data source: CFI, February 2001.



Data source:
(1) "Natural gas 1990–1999." CFI, 2001.
(2) "Other fuels 1990–1999." Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999*, January 2001, Simon Fraser University.

PROFILE *Canada's food processing sector includes manufacturers producing a diverse range of products, including meat, poultry, fruit and vegetables, flour and bakery products, oils and sugars, coffee, snack foods, soft drinks and confections.*

FOOD PROCESSING

PERFORMANCE HIGHLIGHTS

- **In 2000, the Baking Association of Canada, the Canadian Council of Grocery Distributors, the Canadian Meat Council and the Alberta Food Processors Association signed letters of co-operation with CIPEC.**
- **Companies within the food processing industry addressed energy peak costs by making power factor corrections, sizing motors to match demands and sequencing the start-up of heavy equipment.**
- **Unilever adopted an "energy wise" program where the company offers to cover the cost of energy efficiency audits of its employees' homes.**
- **Targets for energy efficiency goals in the food processing sector were set, after polling member companies.**
- **The industry recorded an energy intensity improvement in 1999 of approximately 6.39 percent compared with 1990.**

ACTIONS The Food Processing Task Force, supported by the Food and Consumer Products Manufacturers of Canada (FCPMC), continued to broaden its membership and increase awareness of energy issues within the industry during the 1999/2000 year. The FCPMC represents over 180 Canadian-operated member companies that manufacture and market a wide array of food and consumer products. The industry currently generates over $18 billion annually in GDP (13.4 percent of the manufacturing GDP) and employs 250 000 Canadians directly in every region in Canada. In addition, the bakery industry includes more than 10 000 establishments.

In the 1999/2000 year, the sector appointed Tim Moore of The Clorox Company of Canada Ltd. as its "CEO Champion," and member companies were canvassed to set energy intensity reduction targets covering the next 10 years.

The sector held customized monitoring and tracking workshops in February 2000 and a workshop on identifying energy-savings opportunities, adapted for the food industry, in November 2000. The Alberta Food Processors' Association, a recent CIPEC signatory, commissioned a report and two workshops on "How to Improve Your Business Sustainability and Profits by Reducing Greenhouse Gas Emissions" as part of a program to reduce greenhouse gases (GHGs) by 25 percent at 18 facilities in Alberta.

Companies within the food processing industry addressed energy-peak costs by making power factor corrections, sizing motors to match demands and sequencing the start-up of heavy equipment. The industry is showing a growing interest in energy audits to help define potential energy savings. This interest grows proportionately with increases in energy prices.

Individual members continue to invest in energy efficiency. Following are some examples.

Unilever Canada Limited adopted an "energy wise" program where the company subsidized the cost of energy efficiency audits and energy retrofits at its employees' homes.

Niagara Country Fresh Poultry of West Lincoln, Ontario, has introduced a program to improve the efficiency of its water and waste-water systems.

DC Food Processing, a division of HMR Foods Partnership, Waterloo, Ontario, launched an electrical efficiency project which incorporates monitoring and tracking systems to enable the company to achieve energy savings by controlling air movement through temperature-controlled spaces.

Kraft Canada Inc. reports that its total energy consumption in 1999 was 10.2 percent below 1994 levels, 1994 being the year in which the company began tracking energy consumption data.

Maple Leaf Pork installed a direct contact hot water heater at its Burlington, Ontario, pork processing plant. The heater, which replaced a conventional steam system, will reduce the fuel used per unit of water heated by 25 percent.

New Brunswick's Connors Bros. Limited, a subsidiary of George Weston Limited, has been committed to energy efficiency for more than two decades. For the last three years, the sardine cannery has been converting to energy-efficient lighting throughout the facility. The plant has also slashed its freshwater use by pumping in seawater to assist in air conditioning.

Maple Leaf Consumer Foods has recently installed blowdown heat recovery and vent condensing systems at its Winnipeg, Manitoba, plant, saving the company more than $32,000 per year on fuel, water and boiler chemicals.

Casco Inc. is one of only four Ontario businesses to win a Platinum Business Award for outstanding waste-reduction efforts. Casco's Cardinal corn wet-milling operation annually diverts about 97 percent of its waste away from landfill.

ACHIEVEMENTS Recent energy price increases in natural gas (the sector's main fossil fuel) and the looming electrical deregulation in Ontario have led many food companies to take a fresh look at energy projects which were previously shelved. Higher energy costs have improved the pay-back equations of many energy projects competing with other activities for capital investment funds. Off-book financing and performance contracting for energy-related activities have also attracted rising interest over the past year.

The Food Processing Sector Task Force continued to build its base of support in 2000. Letters of co-operation were signed by the Baking Association of Canada, the Alberta Food Processors Association, the Canadian Meat Council and the Canadian Council for Grocery Distributors. The Fisheries Council of Canada is also considering joining the Food Processing Task Force.

Bringing these associations into the fold means that a major portion of food industry energy users across Canada will be able to benefit from the support services available – through CIPEC – from Natural Resources Canada's Office of Energy Efficiency. Currently, food processors in Alberta are participating in CIPEC activities through the western Canada General Manufacturing Task Force, while opportunities exist in eastern Canada for food industry activities to draw participation from other sectors. Such cross-sectoral efforts are helping to extend CIPEC's reach to companies across all regions of Canada.

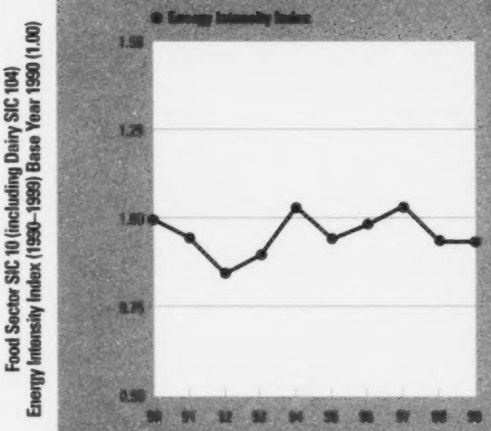
The food processing sector's energy consumption approached 93 092 TJ in 1999, up from 85 608 TJ in 1990. Since 1990, use of electricity and steam in the food processing sector has increased, while use of heavy fuel oil has declined. In general, the industry recorded an energy intensity improvement in 1999 of approximately 6.39 percent compared with 1990.

Targets for energy efficiency goals for the food and consumer products industries were set, after polling member companies. For the years 2000–2005, the sector anticipates an average reduction in energy use of 2.2 percent per year. From 2006 to 2010, the sector's goal is an average reduction of 1.7 percent per year, for a total of 19.5 percent over the next 10 years.

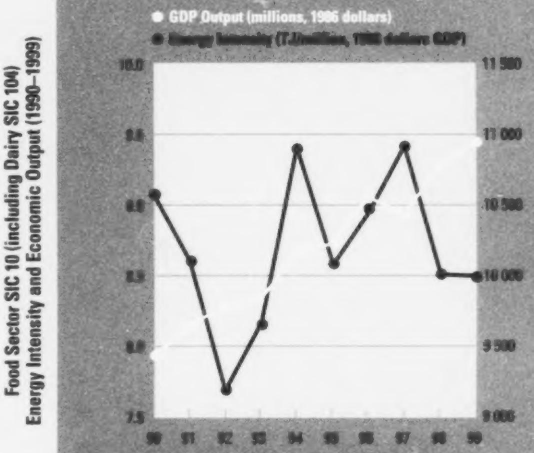
The food processing sector continues to operate under the CIPEC umbrella and to abide by industrial targets set for the sector. Data collected under CIPEC have been forwarded to Agriculture and Agri-Food Canada to support its National Climate Change Issue Table efforts.

CHALLENGES Energy intensity reductions in the food industry continue to improve as companies produce at near optimal capacity. The true measure of energy intensity reduction efforts will be found if the sector's production and exports slow down.

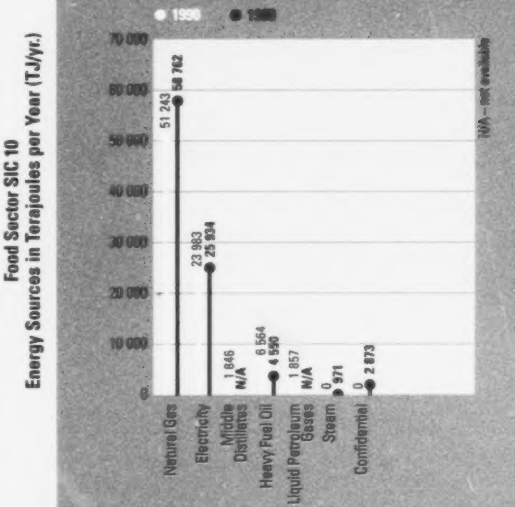
Compared to other environmental issues such as solid waste disposal and water contamination, energy consumption is nearly invisible to many operators. The sector's challenge is to make management and employees aware that energy is a costly raw material that can be managed for maximum efficiency, not a fixed overhead necessary to maintain comfort levels. As energy prices continue to rise, the industry will be challenged to find new ways to reduce this significant component of food production costs.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).

PROFILE ***A high percentage of all manufactured goods depends either directly or indirectly on the castings produced by Canada's foundry industry. Industries relying on castings include the automotive sector, construction, agriculture, forestry, mining, pulp and paper, heavy industrial machinery and equipment, aircraft and aerospace, plumbing, soil pipe, municipal road castings, defence, railway, petrochemical, electric distribution and a myriad of specialty markets. There are approximately 200 foundries in Canada, employing 15 000 people and generating annual sales of $2 billion. About 80 percent of the foundry sector's production is exported.***

FOUNDRY

PERFORMANCE HIGHLIGHTS

- Canada's 200 foundries employ 15 000 people and generate annual sales of over $2 billion.
- ESCO's power-monitoring program has cut electricity costs by $60,000 per month at the company's Port Hope, Ontario, facility.
- A new cooling drum at Bibby-Ste-Croix will save the company $250,000 per year.
- Gamma Foundries has converted its facilities to high-efficiency lighting and is capturing waste process heat for space heating.
- Wabi Iron & Steel expects its new energy efficiency efforts to save between 5 percent and 10 percent on its annual energy costs.
- Environmental and cost concerns continue to drive fuel switching and the introduction of more energy-efficient equipment and methods within the sector.

ACTIONS Canada's foundries continue to focus on a multifaceted, industry energy efficiency improvement strategy. This strategy begins with goal setting and includes operational improvements, monitoring and targeting energy cost centres, investments in energy-efficient processes and technology, and employee training and awareness programs. Also included are the establishment of energy monitoring and control systems and the reclaiming of process heat for use in other operations. A number of foundries have reported notable energy efficiency actions.

For example, ESCO Limited – Port Hope Operations has established an energy conservation team at its Port Hope, Ontario, foundry to examine consumption patterns and explore available energy savings opportunities. The team's efforts have led to a significant modification of energy patterns to take advantage of cheaper "off peak" electricity rates and cut the foundry's electrical costs in half, saving the company more than $60,000 per month. ESCO has installed an E2MS electrical monitoring system and is seeking ways to expand monitoring to its natural gas, propane, air and water usage. The company is also refitting its compressed-air system to eliminate leaks and cut down on the air needed to carry out plant functions.

Wabi Iron & Steel Corporation has established an energy efficiency action plan, which includes a formal target-setting and review process. The company has adopted a strategy combining operational improvements, monitoring and targeting, capital investment and employee awareness. In 2000, Wabi Iron & Steel established an energy-management team at its New Liskeard, Ontario, plant, and launched an energy-usage monitoring program. The company expects to save between 5 percent and 10 percent on its annual energy costs by implementing measures that offer a payback in one year or less.

Gamma Foundries Limited has taken an aggressive approach to energy efficiency at its Richmond Hill, Ontario, facilities. The company has installed high-efficiency sodium lighting throughout its facilities, added motion-activated lighting in its lunchrooms, upgraded water heaters and installed power correction capacitor banks. Gamma Foundries has also installed its furnace cooling heat exchangers indoors, capturing waste heat and using it to heat the plant.

Bibby-Ste-Croix Foundries in Sainte-Croix, Quebec, has installed a cooling drum to maintain mould sand at a constant, cooler temperature. Cooler sand leads to better moulds and fewer rejected castings and is expected to enable the company to save in excess of $250,000 per year. The project will pay for itself in savings within 18 months.

The Ford Motor Company of Canada Limited's Windsor Casting Plant has undertaken a number of energy-reduction activities as part of a five-year action plan. In 2000, the plant upgraded its heat treat gas oven and Venetta dryer controls, leading to a reduction in natural gas consumption of 2.7 million m^3. The plant also completed a program to identify and repair leaks throughout its compressed-air and hydraulic delivery systems.

At the sector level, the Canadian Foundry Association, supported by NRCan's Office of Energy Efficiency (OEE), has launched a two-year work plan to improve the sector's energy efficiency. Included in the first phase of the plan are the accumulation of appropriate baseline information on foundry energy use, the creation of a best practices sector energy guide and the development of a customized, one-day energy efficiency workshop based on the OEE's highly successful "Dollars to $ense" workshops. Foundry benchmarking data will be available in early 2001, and the sector's *Energy Efficiency Guidebook* is scheduled for publication later in the year. The first workshop was held in 2000, with three others scheduled for 2001.

ACHIEVEMENTS

Environmental and bottom-line concerns, driven in recent months by the rapidly rising costs of energy, continue to motivate Canada's foundries to implement energy efficiency improvements and reduce greenhouse gas (GHG) emissions. A number of foundries have signed on as Industrial Energy Innovators. Many companies no longer use GHG-generating fuels such as coal, oil or coke in their operations and have eliminated the use of steam produced by coal-generated electricity.

Escalating oil, natural gas and power costs are leading a growing number of companies to adopt more energy-efficient equipment and methods and to turn to fuel switching and waste-energy capture programs. Active energy efficiency programs throughout the industry have led the sector to expect record improvements in its energy efficiency performance in the months ahead.

One advance that promises to help foundries cut wasted energy is a recently released furnace power-management software system that provides real-time demand management features. By automatically controlling furnace loads at optimal levels, the system can significantly reduce the energy used in the casting process.

CHALLENGES

Over the past decade, demands on foundries to provide diversified, value-added services to their customers have grown substantially. Today, many foundries no longer simply provide raw castings. They are expected to design parts, build tooling, cast prototypes and make, machine and assemble the casting. Often, they are called on to produce a completed component or assembly ready for the customer's assembly line. While these additional activities have added to the sector's capabilities, employment and profit, they have also led to increased energy consumption.

Canada's foundries are on an endless search for energy-efficient equipment and methods. To remain competitive today, foundries must closely monitor energy consumption and implement programs to improve energy efficiency. The often conflicting needs to respond to customer demand for expanded services, remain price competitive and meet environmental standards are taxing the resources of many foundries and creating a need for new, cost-effective energy efficiency technologies and solutions.

The sector is currently working with CIEEDAC and the OEE to develop indices and figures.

PROFILE: The general manufacturing sector comprises a variety of industries, including leather, clothing, furniture, printing, machinery, construction materials, floor coverings, imaging products, insulation, adhesives and pharmaceuticals. The sector encompasses approximately 2000 small, medium-sized and large companies that, combined, consumed about 178 578 TJ of energy, or about 6.57 percent of the total energy consumed by all CIPEC sectors in 1999.

GENERAL MANUFACTURING

PERFORMANCE HIGHLIGHTS

- **The approximately 2000 companies included in the general manufacturing category consumed about 178 578 TJ of energy in 1999.**
- **Task forces in Alberta and Quebec have broadened CIPEC's reach in western and eastern regions.**
- **Metroland Printing, Publishing and Distributing has completed a retrofit of its heating, cooling and ventilation equipment that will reduce its energy consumption by 1.5 million kWh.**
- **Crown Cork & Seal was a winner in Canada's Energy Efficiency Awards at Canada's Energy Efficiency Conference 2000 for the installation of a heat exchanger at its Calgary, Alberta, plant.**
- **New technology at Fibrex Insulations Inc. has earned the insulation producer local and provincial recognition for business excellence.**
- **Energy efficiency upgrades at Simmons Canada Inc. helped the company achieve a 12.45-percent reduction in natural gas usage and a 7.28-percent decrease in electrical consumption.**
- **By the end of 1999, S.C. Johnson and Son reduced its energy intensity by 9.7 percent, with further gains from a lighting retrofit and compressed-air upgrade achieved in 2000.**

ACTIONS Regional task forces formed in Alberta and Quebec in 1998 are broadening industry representation in eastern and western Canada while providing forums to address their specific issues. In Quebec, the new regional task force has attracted an active membership that includes associations reaching nearly all corners of the province. The group has become both a focal point and a lightning rod for energy efficiency efforts in Quebec.

The Alberta regional task force is working with associations, companies and governments to address issues arising from deregulation and soaring power costs. Currently based in Edmonton, the group plans to broaden its participation within Alberta and expand its reach into the other western provinces.

Overall, the sector's energy efficiency awareness efforts are being bolstered with the help of other organizations. The Canadian Chamber of Commerce is actively promoting CIPEC by providing information to its members. Natural gas providers Union Gas Limited and Enbridge Consumers Gas offer a range of incentive programs and services designed to help industry conserve energy.

Individual general manufacturing sector members are also making important contributions to energy efficiency. For example, pharmaceutical manufacturer Wyeth-Ayerst Canada Inc. has made significant strides toward meeting a worldwide corporate mandate to reduce energy consumption over three years by 20 percent. Energy efficiency investments at its Saint-Laurent, Quebec, plant have so far reduced annual energy costs by $279,000, with further savings of $184,000 anticipated by 2001.

Owens Corning Canada (Toronto plant), which recently joined the Industrial Energy Innovators Initiative, hired the consulting firm ENRON Canada Corp. to conduct an energy audit of its facilities. As a result, the company was able to reduce air-conditioning power requirements by 26 percent. Owens Corning is also working on improving its compressed-air control systems and on developing a "zero process waste" system.

In addition to its own energy efficiency efforts, Owens Corning is providing a service to other companies seeking to reduce energy use. Owens Corning's Thermal Analysis Service uses digital and infrared thermal imaging technology to locate energy leakage and identify ways to optimize insulation performance. The service enables facilities to save energy and reduce operating costs.

Metroland Printing, Publishing and Distributing Ltd., of Toronto, Ontario, has completed a retrofit of its heating, cooling and ventilation equipment, which will reduce its energy consumption by 1.5 million kWh, or 174.4 kWh/m^2. The three-phase program, which was launched in 1997, replaced and refurbished fans, upgraded filtration and air balance, modernized chiller equipment, replaced the cooling tower and made other improvements at a total cost of $1.4 million.

S.C. Johnson and Son, Limited (Johnson Wax) has formed an internal CIPEC steering committee to review energy use in its Brantford, Ontario, facilities. ISO

14001 certified, the company actively pursues energy savings as part of its aggressive environmental program. By the end of 1999, the company had reduced its energy intensity by 9.7 percent, with further gains from a lighting retrofit and compressed-air upgrade achieved in 2000.

Crown Cork & Seal Canada Inc. is piloting the use of infrared drying technology at one of its Toronto-area plants. The technology appears to reduce the natural gas consumed to dry the coating on aluminum beverage cans by 15–20 percent, saving a projected 85 000 m^3 per annum in natural gas.

Simmons Canada Inc. has launched energy initiatives at its Brampton, Ontario, and Winnipeg, Manitoba, plants. Upgrades to its Brampton tempering ovens and Winnipeg lighting and heating systems helped the company achieve a 12.45-percent reduction in natural gas usage and a 7.28-percent decrease in electrical consumption.

ACHIEVEMENTS The General Manufacturing Sector Task Force continues to pursue activities outlined in its 1999–2000 action plan. Specific elements of the plan include the following:

- achieve an energy efficiency improvement target of 1 percent per annum to the year 2010;
- establish regional task force divisions for western and eastern Canada;
- distribute letters of support for CIPEC and the Industrial Energy Innovators Initiative;
- maintain ongoing collaborative efforts with organizations, including the Canadian Association of Man-Made Vitreous Fibre Manufacturers (CAMMVFM), the Canadian Chamber of Commerce, the Canadian Manufacturers and Exporters Association, Gaz Métropolitain, Duke Solutions, Enbridge Consumers Gas and Union Gas;
- increase the involvement of other associations and firms;
- encourage energy efficiency progress reporting by the sector's Industrial Energy Innovators; and
- share industry ideas and information on energy efficiency opportunities and strategies.

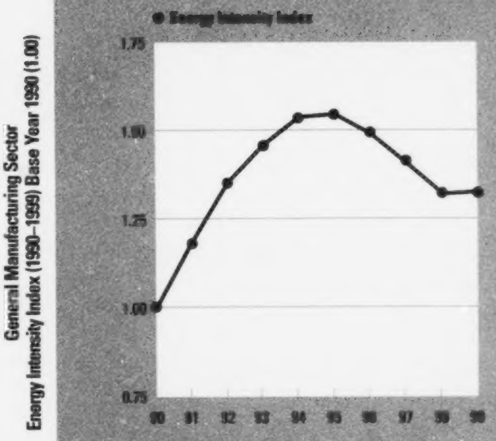
Sector companies continue to earn recognition for their efforts toward improved energy efficiency. Following are two examples.

Crown Cork & Seal was a winner in Canada's Energy Efficiency Awards at Canada's Energy Efficiency Conference 2000 for the installation of a heat exchanger at its Calgary, Alberta, plant. The new device is enabling the company to use waste heat from its air compressors as process heat for its can-washing line.

Industrial Energy Innovator Fibrex Insulations, Inc. has introduced new machinery to produce high-quality rock wool insulation and hydroponic growing material. The machinery took three years to develop and uses the most advanced automation and control technology available. The project has earned Fibrex a Business Excellence Award from the Sarnia-Lambton Chamber of Commerce and a nomination for the Ontario Outstanding Business Achievement Awards sponsored by the Ontario Chamber of Commerce.

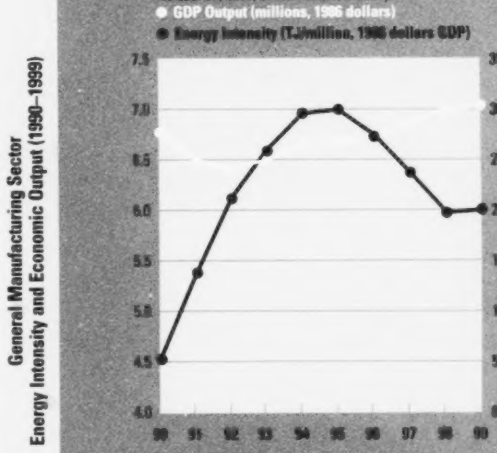
CHALLENGES Manufacturers in the general manufacturing sector must balance the total costs of improving energy efficiency against the need to compete for domestic and international market share with overseas companies not bound by the same constraints. For less energy-intensive companies, the relatively small role energy plays in overall costs makes it difficult to justify major capital expenditures. Where energy is a larger component of overall costs, many manufacturers, especially smaller ones, lack the knowledge and financial resources to identify and act on energy-saving opportunities. Larger companies often find that lack of staff and capital resources to dedicate to energy projects is a significant impediment.

The sector's unusual diversity presents a challenge, making it difficult for its task forces to represent the interests of all of the general manufacturing sector. Compounding difficulties for the sector is the lack of meaningful baseline energy data. Because of changes to the sector's composition, data concerning the General Manufacturing Sector Task Force used in the CIPEC annual reports before 1995/1996 are no longer applicable and cannot be compared with data in later reports.



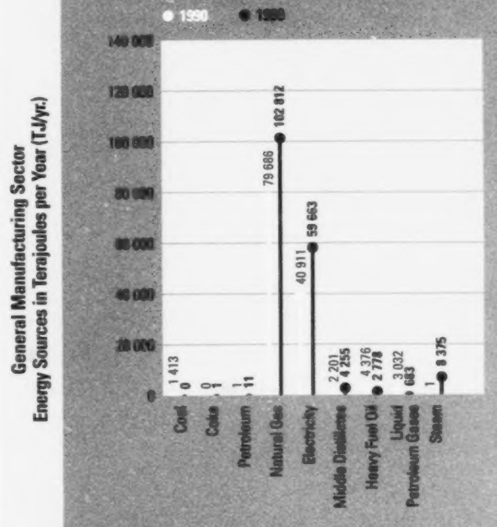
General Manufacturing Sector
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.



General Manufacturing Sector
Energy Intensity and Economic Output (1990–1999)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1998.* October 27, 2000, Simon Fraser University.



General Manufacturing Sector
Energy Sources in Terajoules per Year (TJ/yr.)

Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

*PROFILE: **Canada's merchant lime sector supplies essential raw materials for steel production, mining, pulp and paper manufacturing, water treatment, environmental management and other basic industries. Operating 16 facilities, the sector's four companies directly employed more than 700 people and had a combined lime calcining capacity of 3.1 million tonnes in 1999. From 1998 to 1999, lime production rose by 1.3 percent, with a total increase of 26.5 percent from 1990 to 1999.***

LIME

PERFORMANCE HIGHLIGHTS

- **From 1990 to 1999, the lime sector increased production by 26.5 percent.**
- **Graymont (NB) Inc. cut the fuel used in its kilns by 440 000 litres per year.**
- **Graymont (QC) Inc. is making a strong march toward energy efficiency at its three Quebec plants.**
- **Beachville Lime's recently upgraded capacitors raise its power factor from 86 percent to 96 percent.**
- **While the sector's total energy consumption increased by 2231 TJ between 1990 and 1999, the energy intensity index decreased by 9.1 percent.**
- **Companies representing 98.7 percent of the lime production capacity in Canada's merchant lime sector are now Industrial Energy Innovators.**

ACTIONS Individual companies in the lime sector continue to make significant energy efficiency improvements. For example, Graymont (NB) Inc. has installed variable frequency drives on fans and blowers to reduce power consumption, introduced an environmental management system emulating the ISO 14000 International Environmental Standard and taken steps to improve the efficiency of its kilns. These actions have enabled Graymont (NB) Inc. to cut its total energy consumption in the kiln process from 105.8 litres of oil per tonne of product to 99.6 litres, leading to an annual reduction in fuel consumption of 440 000 litres.

Graymont (QC) Inc. is making a strong march toward energy efficiency throughout its three Quebec plants. At its Bedford facility, the company installed large, energy-efficient motors and a new preheater rotary lime kiln. At Joliette, a high-efficiency draft fan in the number two kiln cut horsepower requirements by half, thereby reducing power consumption. At Marbleton, the company has established a state-of-the-art plant with energy-saving kiln technology, including the use of computerized controls for superior process stability, quality control and energy efficiency.

Capacitor upgrades at Beachville Lime Limited have improved the power factor at the company's Ingersoll, Ontario, facility from 86 percent to 96 percent, thereby ensuring transformer efficiency and eliminating future power factor penalties.

In 2000, Beachville Lime, Dundas Lime Limited and Northern Lime Limited became Industrial Energy Innovators. With the addition of these three companies, Industrial Energy Innovators account for 98.7 percent of production capacity in the Canadian merchant lime sector.

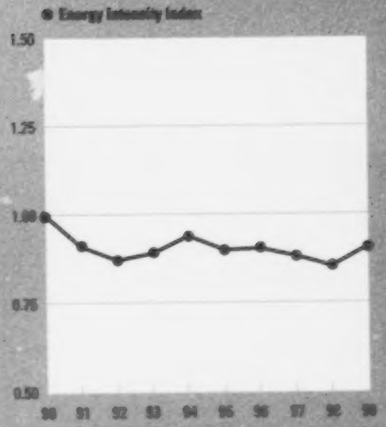
ACHIEVEMENTS Companies represented by the Canadian Lime Institute continue to work actively to improve the energy efficiency of their operations. While total energy consumption increased by 2231 TJ between 1990 and 1999 (as production increased by 26.5 percent), the energy intensity index decreased by 9.1 percent. In 1999, the energy intensity index increased 5.5 percent from 1998 levels. The sector's target is a continuing improvement at a rate of 0.3 to 0.5 percent per year through to 2001. Since the 1970s, the merchant lime sector has decreased its energy intensity by an estimated 18.5 percent.

Greenhouse gas (GHG) emissions resulting from the production of lime are offset to some extent by the reabsorption of CO_2 by lime during its life cycle. The National Lime Association estimates that more than 25 percent of the lime produced in Canada and the U.S. reabsorbs CO_2 either in process or naturally.

CHALLENGES The production of lime occurs at high temperatures using large quantities of combustion fuel. Natural gas is the principal fuel source, with petroleum, coke and coal making up most of the balance. In an industry heavily dependent on such fuels, rapidly rising fuel prices make energy efficiency a top priority. However, while ongoing refinements continue to be made to existing calcining equipment, substantial capital investments in new, more efficient kiln installations are needed in order to make major gains. Lime producers continue to be challenged to find the capital necessary for such investments.

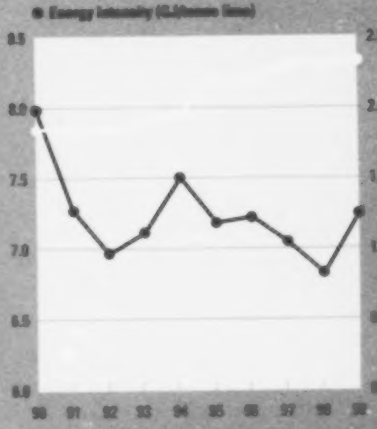
Producers are also challenged to balance energy efficiency with quality. Fuel switching and high-efficiency large kiln technology may reduce energy requirements, but they can also interfere with product quality, a significant concern for some of the sector's largest customers.

Lime Sector SIC 3581
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



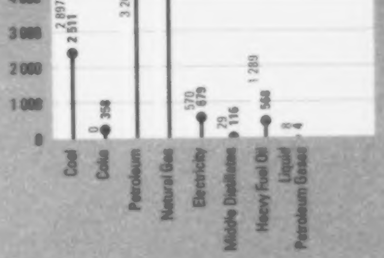
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Lime Sector SIC 3581
Energy Intensity and Physical Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Lime Sector SIC 3581
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE: Canada's well-established mining industry directly employs 386 000 people, with an annual payroll of $4.2 billion in its mining, smelting and refining activities. In 1999, the sector's output was valued at $27.7 billion, or 3.7 percent of the nation's GDP. The Canadian mining sector exports roughly 80 percent of its production, valued at $44 billion, or 13.3 percent of total domestic exports. Canada's mineral and metal exports increased by 52 percent between 1993 and 1999.

MINING

PERFORMANCE HIGHLIGHTS

- **Since 1989, anode production at Noranda's Horne Smelter rose 40 percent while energy consumption declined 8.1 percent, GHG emissions decreased 25.1 percent and energy intensity fell 34.4 percent.**
- **At Noranda's Gaspé Smelter, energy intensity improved by 32.5 percent and GHG intensity dropped by an impressive 37.5 percent over the past decade.**
- **Falconbridge's Sudbury Division completed a mine-ventilation automation project that is expected to reduce power consumption by 25 GWh per year.**
- **INCO has established a formal Energy Breakthrough system to establish a system-wide approach to energy conservation and GHG emissions reductions.**
- **MAC has developed *Strategic Planning and Action on Climate Change – A Guide for Canadian Mining Companies*, a handbook to help companies plan, implement and report climate change actions.**

ACTIONS Energy efficiency is a priority for members of the Mining Association of Canada (MAC), in their efforts to reduce production costs and contribute to Canada's overall global competitiveness.

For example, Noranda Inc. adapted its Horne Smelter in Rouyn-Noranda, Quebec, to handle electronic scrap and other secondary materials containing gold, copper, silver and other metals. At the facility, a metallurgical acid plant with advanced gas-cleaning equipment processes off-gas from the reactor and continuous converter, while Pierce-Smith converters are being adapted for desulphurization. From 1989 to 1999, anode production rose 40 percent, while energy consumption declined 8.1 percent, greenhouse gas (GHG) emissions decreased 25.1 percent and energy intensity fell 34.4 percent.

Similar results were achieved at Noranda's Gaspé, Quebec, smelter. While production rose by a substantial 63.4 percent between 1989 and 1999, energy consumption increased by only 10.2 percent. Energy intensity improved by 32.5 percent, and GHG intensity dropped by an impressive 37.5 percent. Company-wide, GHG emissions compared with the 1989 base year are 36.6 percent below "business as usual" levels.

In Ontario, the Sudbury Division of Falconbridge Limited completed a mine-ventilation automation project. This undertaking uses sophisticated underground technologies to control main and auxiliary ventilation fans and to monitor air quality and vehicle location. The potential total reduction in energy consumption is 25 GWh per year, which represents an annualized savings of $1.4 million. In addition, the division achieved natural gas consumption reductions totalling 3.2 GWh, leading to a 0.6-kilotonne decrease in direct GHG emissions.

INCO Limited has established the foundation for a new concept in energy management. Called the Energy Breakthrough (EB) system, the initiative embodies a system-wide approach to energy conservation and GHG emissions reductions and has set aggressive energy-reduction targets. INCO is backing up its efforts with a strong internal and external communications program designed to raise awareness of environmental issues. The EB system builds on a successful energy-reduction track record that has seen the company's overall energy consumption decrease by 15.2 percent, from 21 035 TJ in 1990 to 17 837 TJ in 1999.

In addition to individual actions, MAC members are working together to advance energy efficiency. For example, 10 Canadian mining operations participated in an energy benchmarking study of underground bulk mining, which presented an overall framework for GHG emissions analysis as well as individualized reports for each company. Open-pit mining energy benchmarking activities involving MAC and Natural Resources Canada (NRCan) are pending. In addition, MAC, in conjunction with Industry Canada and NRCan, completed an energy cost-curve analysis.

MAC has developed a handbook called *Strategic Planning and Action on Climate Change – A Guide for Canadian Mining Companies*, a publication designed to present companies with a process for planning, implementing and reporting climate change actions. The association's energy managers' Internet chat line, designed to facilitate the sharing of information and best practices and to provide assistance in solving energy problems, continues to attract the participation of Canadian mining companies.

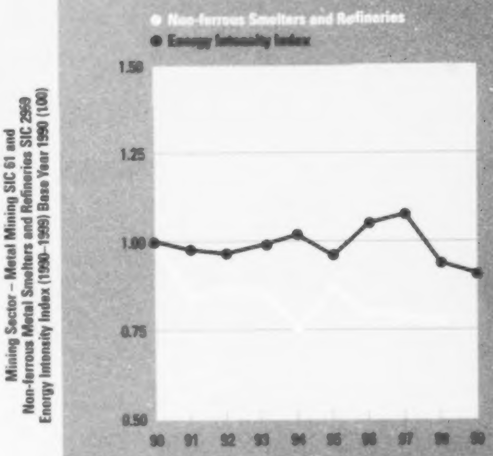
MAC is actively engaged in Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.), the National Advisory Council on Energy Efficiency's board and several Climate Change Issue Tables. As of December 2000, 16 of MAC's 33 members, representing most of the energy consumption related to metal mining and non-ferrous smelting and refining, had submitted action plans to VCR Inc., and MAC continues to work vigorously to increase participation. Also in 1999, MAC contracted two recognized environmental consultants, the Pembina Institute for Appropriate Development and Resource Futures International, to provide guidance on developing corporate strategies and action plans to help members meet the challenges of reducing GHG emissions while also building international competitiveness.

ACHIEVEMENTS The metal mining industry's energy mix is heavily weighted toward electricity (48.05 percent), followed by heavy fuel oil (15.70 percent) and middle distillates (14.56 percent). In 1999, total energy use in the metal mining sector was 71 423 TJ, or 2.63 percent of total Canadian industrial energy consumption. Compared with 1990, metal mining energy use was 29.6 percent lower in 1999.

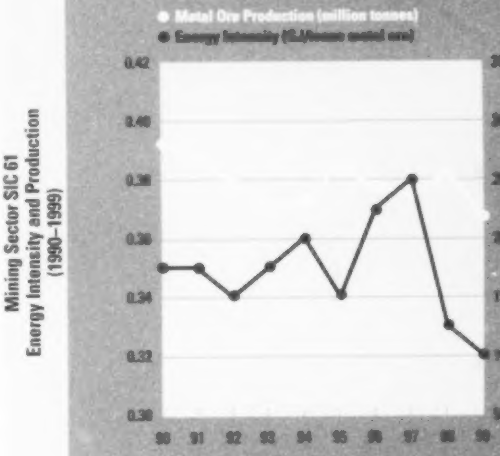
The non-ferrous metal smelting and refining industry (excluding aluminum and magnesium) has an energy mix weighted toward electricity (48.6 percent), followed by natural gas (25.6 percent) and coal (12.6 percent). In 1999, total energy use was 84 068 TJ. Compared with 1990, the industry's energy use was 3.5 percent higher in 1999 due to higher levels of production. Total GHG emissions (direct, indirect and other) were 7.5 percent lower in 1999 than they were in 1990.

CHALLENGES A combination of increasing energy costs, fluctuating international metal prices, stiff competition and rapid technological change continues to put pressure on the mining sector's resources. Despite these challenges, the Canadian mining industry remains an economic and technological leader, investing billions of dollars in capital projects, and ranks among the top 10 Canadian industrial sectors in productivity growth.

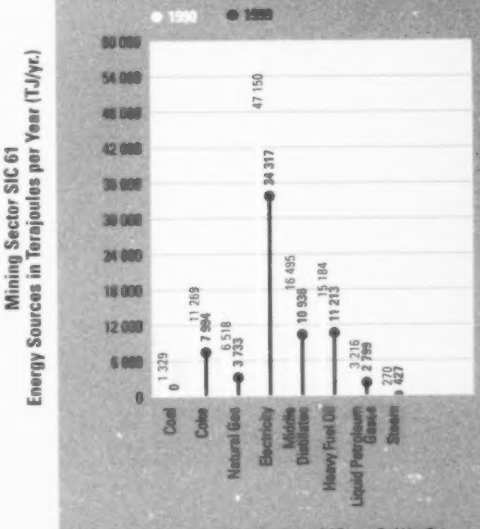
Despite improvements in energy use per unit of output and in recording emissions throughout the 1990s, the mining sector will be challenged as the industry expands and energy requirements grow. Energy represents between 10 and 25 percent of production costs, making energy efficiency an important part of the industry's overall competitiveness strategy. Thus, it is imperative for MAC to continue to bolster the industry's energy efficiency efforts. Members believe that, despite global economic challenges, the mining sector will continue to make substantial energy efficiency gains.



Data source for SIC 2959: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Canadian Minerals Yearbook, 1998, A Review of Energy Consumption and Related Data: Canadian Mining and Metal Refining Industries 1990 to 1997.*



Data source for SIC 61: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 2001, Simon Fraser University.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 2001, Simon Fraser University.

PROFILE Canada's oil sands sector includes two plants in northern Alberta and one heavy oil upgrader in Saskatchewan. Together, these facilities produce more than 300 000 barrels per day of crude oil for markets in Canada and the U.S. The sector is a major employer and a significant contributor to Canada's GDP.

OIL SANDS

PERFORMANCE HIGHLIGHTS

- The oil sands sector is committed to ongoing improvements in its energy efficiency and intensity, through a combination of operational excellence and technological innovation.
- Husky Oil began drawing power from a cogeneration project at its Lloydminster, Saskatchewan, site, reducing GHG emissions by 168 000 tonnes of CO_2 per year.
- Suncor's oil sands emissions per unit of production in 1999 bettered the company's targets and improved on 1998 results by 10 percent.
- From 1988 to the end of 1999, Syncrude cut CO_2 emissions per barrel of oil produced by 26 percent.
- The upcoming Athabasca Oil Sands Project is committed to a best practices approach to environmental management.
- In 1999, energy consumed per unit of production fell to 7.98 GJ/m³, a 4.32-percent improvement over 1998 and a total improvement of 28.3 percent since 1990.

ACTIONS The oil sands sector is committed to ongoing improvements in its energy efficiency, through a combination of operational excellence and technological innovation. Plants are improving the reliability of their operations and introducing programs to recover waste heat and boost yields through more efficient processing. Other gains have come from the introduction of new technologies in the mining and extraction stages.

In late 1999, Husky Oil began drawing power from the Meridian Cogeneration Project at its Lloydminster, Saskatchewan, heavy oil upgrader site. The project is a joint effort with TransAlta Energy Corporation, the cogeneration plant's operator. Steam transferred from the plant has enabled Husky to reduce the heat in some of its boilers, leading to an estimated emissions reduction equivalent of 168 000 tonnes of CO_2 per year. A further 14 000-tonne reduction in CO_2 equivalent was achieved when Husky optimized process controls on its upgrader power boilers.

Suncor Energy Inc., Oil Sands has employed strategies such as debottlenecking and eliminating pressure drops in its steam system, improving extraction energy efficiency, increasing the use of coker gas and reducing flaring to achieve reductions in its greenhouse gas (GHG) emissions. Emissions per unit of production in 1999 beat the company's targets and bettered 1998 results by 10 percent. At 0.738 tonnes of CO_2 equivalent per unit of production, 1999 results were 30 percent below the benchmark 1990 level. Suncor forecasts that a combination of new technologies, processing improvements and other efficiency initiatives will lead to a further drop in GHG emissions to 0.572 tonnes of CO_2 equivalent by 2005.

Syncrude Canada Ltd. is in the midst of an 11-year strategic capital investment program called "Syncrude 21." Begun in 1997, the program aims to upgrade oil sands operations, thereby improving energy efficiency and GHG emissions. The first stage of this four-stage program, which covers the company's new North Mine and several debottleneck projects in its upgrader, has been completed, and the new facilities are in operation. The second stage, which includes the first train of the company's Aurora Project and further debottlenecking of bitumen processing units, was put into operation in the second quarter of 2000. "Syncrude 21" and predecessor activities have had a significant impact on the company's energy efficiency and, subsequently, on GHG emissions. From 1988 to the end of 1999, Syncrude cut CO_2 emissions per barrel of oil produced by 26 percent. The company estimates that by 2008 the total reduction will improve to 42 percent.

The Athabasca Oil Sands Project, announced late in 1999, is committed to a best practices approach to environmental management. The project plans to build on the experience of existing oil sands operators and implement new technologies to increase

environmental performance in all of its new facilities. Energy efficiency is a priority for the project, and the Athabasca consortium plans to use gas-fired cogeneration at both of its facilities. The project expects to begin operations late in 2002.

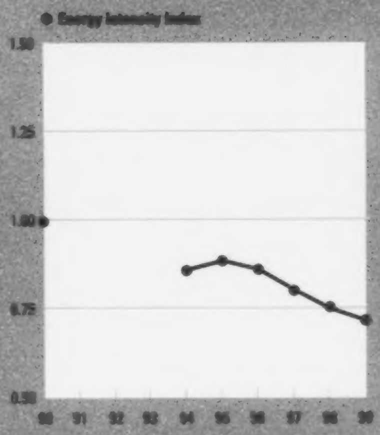
ACHIEVEMENTS In 1999, the oil sands sector continued its march toward energy efficiency. Energy consumed per unit of production fell to 7.98 GJ/m^3, a 4.32-percent improvement over 1998. This compares favourably with the sector's target of a 1-percent minimum average improvement in energy efficiency per unit of production. While total annual production rose 46.29 percent since 1990, energy use rose only 25.66 percent. In 1999, energy consumption totalled 177 599 TJ. Energy intensity showed a total improvement of 28.3 percent since 1990.

Oil sands industry members continue to emphasize energy efficiency and are constantly pursuing ways to minimize the impact of their operations on the environment. Their commitment is reflected in their efforts to reduce the use of coke by switching to natural gas, resulting in a significant reduction in GHG emissions.

CHALLENGES The sector's principal challenges are technological and financial. Oil sands operators must continue to combine investment in innovative technologies with operational excellence to reduce the energy consumed in production. Better, less energy-intensive extraction methods must be implemented, and material-handling systems must be modified to more efficiently accommodate increasing production loads.

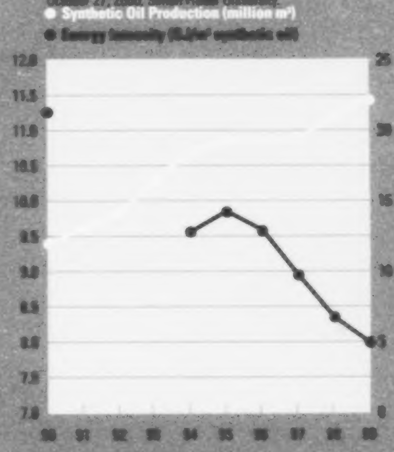
This process is both time-consuming and expensive. The long lead times and substantial investments required to introduce enhancements continue to force difficult choices on the industry and affect the sector's progress toward greater energy efficiency.

Oil Sands Sector SIC 712
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



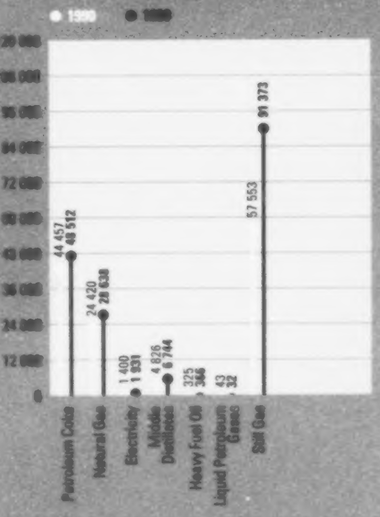
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Oil Sands Sector SIC 712
Energy Intensity and Physical Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Oil Sands Sector SIC 712
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE: *Canada's petroleum products sector markets gasoline, diesel, heating oil, jet fuels, lubricating oil, grease, food-grade white oils, asphalts and aromatic hydrocarbons through a network of more than 15 000 wholesale and retail outlets nationwide. Operating 21 oil refineries across the country, the industry provides direct employment for 100 000 Canadians and generates an additional 100 000 indirect jobs (*Employment in the Canadian Petroleum Industry, *Canadian Energy Research Institute, Special Report 2000–1, September 2000).*

PETROLEUM PRODUCTS

PERFORMANCE HIGHLIGHTS

- **The industry operates 21 oil refineries across the country and provides 100 000 direct jobs.**
- **Parkland Refining has improved its energy efficiency index by 25 percent since 1990.**
- **Ultramar has made a number of capital investments to improve energy efficiency at its Saint-Romuald, Quebec, refinery.**
- **Irving Oil Limited has included more than $100 million worth of environmental controls in its $1-billion Saint John refinery upgrade project.**
- **Petro-Canada has introduced improvements in 1999 that cut more than 36 000 tonnes of GHG emissions and saved over 700 000 GJ of energy.**
- **Imperial Oil Limited initiated or evaluated projects that could reduce CO_2 emissions by 21 400 tonnes per year.**
- **Shell Canada plans to spend $50 million for energy efficiency capital improvements at its three refineries between 2000 and 2005.**
- **Sunoco has targeted an annual improvement of 2 percent per year over the 2002–2008 period.**
- **In 1999, the sector's energy intensity index stood at 92.1, a 1.39-percent improvement since 1998 and 18.3 percent better than in 1990.**

ACTIONS Member refineries of the Canadian Petroleum Products Institute renewed their commitment to energy efficiency by extending the goal to improve refining the sector's energy intensity index by 1 percent per year through to 2005.

The Canadian Association of Petroleum Producers, in co-operation with the Canadian Energy Research Institute, held a two-day best practices conference entitled "Voluntary Actions by the International Oil and Gas Industry to Address Climate Change" in April 2000. The conference covered topics such as best practices for emissions measurement and reduction, ways to reduce the energy and carbon intensity of oil and gas, fuels of the future and developing partnerships with the auto industry.

Individual Canadian refiners continue to invest in capital projects and operate programs that enhance energy efficiency.

Parkland Refining Ltd.'s Bowden, Alberta, refinery has upgraded electrical equipment to improve power efficiency, installed an efficient new crude heater and increased refinery throughput to reduce its energy intensity. These and other measures have enabled the facility to improve its energy efficiency index by 25 percent since 1990.

Ultramar Ltd.-Saint-Romuald Refinery has made a number of capital investments to improve energy efficiency at its Saint-Romuald, Quebec, refinery. The company introduced process modifications to reduce wasted steam in its air cooler, including an automatic louvre system, saving the company 240 tonnes of steam per day for six months of the year. Additional steam is being saved through the ongoing installation of pipeline insulation. In 1999, the company began using water from the fluidized catalytic cracker (FCC), instead of boiler feed water, to wash the FCC air coolers, saving 70 tonnes per day in steam.

Irving Oil Limited has included more than $100-million worth of environmental controls in its $1-billion Saint John, New Brunswick, refinery upgrade project. Combined, these environmental controls will reduce the plant's CO_2 emissions by 670 000 tonnes per year. The refinery was awarded an Honourable Mention citation at Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) 1999 Leadership Awards Ceremony.

Petro-Canada has introduced improvements at a number of refineries. These measures have significantly improved energy intensity and reduced greenhouse gas (GHG) emissions. Between 1994 and 1999, the company's downstream operations achieved an overall 7-percent improvement in energy intensity. Actions taken in 1999 alone cut more than 36 000 tonnes of GHG emissions and saved over 700 000 GJ of energy. The company earmarked $4 million specifically for energy efficiency projects in 2000.

Imperial Oil Limited initiated or evaluated a number of replacements, upgrades and process-control enhancements at its facilities in 1999 and 2000, which could reduce CO_2 emissions by 21 400 tonnes per year. Along with its parent and sister companies, Imperial Oil will soon roll out its Global Energy Management System, a key tool in the company's efforts to improve energy efficiency in its manufacturing operations.

Shell Canada Limited now makes on-line energy efficiency calculation available to operators on many of its processing units to provide real-time feedback, tracking, target setting, accountability and optimal energy utilization. The results directly impact the company's bonus and profit-sharing programs. Shell plans to spend $50 million for energy efficiency capital improvements at its three refineries between 2000 and 2005. Expansion and modifications at the company's Scotford, Alberta, refinery are expected to reduce CO_2 emissions by a combined 300 000 tonnes per year.

Suncor Energy Inc.-Sunoco Group's refinery is undergoing a business plan review to achieve further improvements in energy management and GHG emissions. A proposed cogeneration plant at the Sarnia, Ontario, facility is expected to cut GHG emissions by 174 600 tonnes of CO_2 equivalent annually. Since 1990, the company has reduced emissions by 6.4 percent despite a production increase of 3.2 percent over the same period. In 1999, Sunoco set an aggressive new energy efficiency goal for the refinery – an annual improvement of 2 percent per year over the 2002–2008 period.

Chevron Canada Limited-Burnaby Refinery continued its focus on energy efficiency into 2000, including the installation of new burners and attention to steam-trap maintenance and insulation.

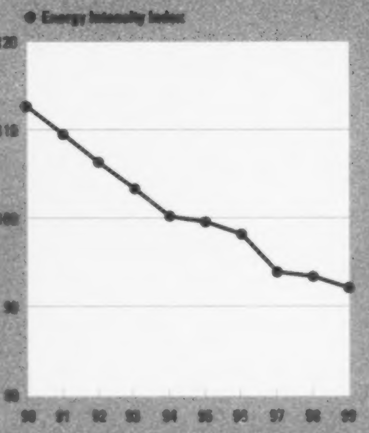
Mobil Oil Canada was awarded Gold Level Champion Reporter status by VCR Inc. for its action plans to reduce GHG emissions.

ACHIEVEMENTS Production of petroleum products continued to grow in 1999, while the industry's energy intensity decreased. During the year, production rose by 0.8 percent over 1998, while energy intensity fell by 0.98 percent to 2.43 GJ/m³. Compared with the 1990 base year, the sector's total energy consumption has decreased by 6 percent to 250 134 TJ. Between 1998 and 1999, energy consumption decreased by 391 TJ, or 0.15 percent. In 1999, the sector's energy intensity index stood at 92.1, a 1.39-percent improvement since 1998 and 18.3 percent better than 1990, exceeding the industry's commitment of a 1-percent-per-year improvement.

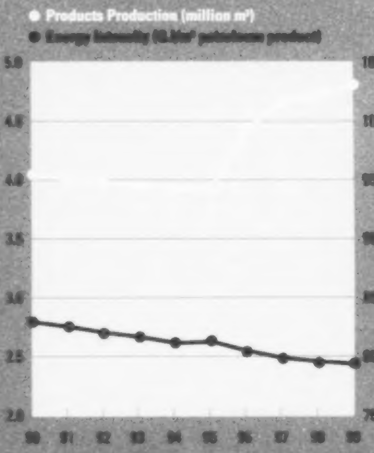
CHALLENGES Pressures for increased production in the face of economic uncertainty and escalating crude costs will make ongoing energy efficiency improvements more challenging. Since higher-capacity utilization improves refinery efficiency, thereby lowering the energy required per unit of output, refiners will be challenged to maintain production at optimum levels in a period of unpredictable demand. In 1999, capacity utilization was 90.2 percent, compared with 89.5 percent in 1998.

The industry also faces increasing pressure to reduce the benzene and sulphur levels in gasoline and diesel fuels. Meeting increasingly stringent content standards requires refineries to employ more energy-intensive methods, processes which make it more difficult and expensive to reduce CO_2 emissions. New energy efficiency concepts will be needed for the industry to maintain its trend of continuous improvement.

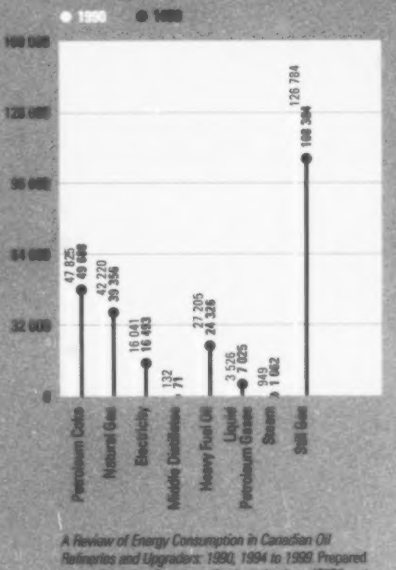
Petroleum Products Sector SIC 3611
Solomon Energy Intensity Index (1990–1999) Base Year 1990 (112.7)



Petroleum Products Sector SIC 3611
Energy Intensity and Physical Output (1990–1999)



Petroleum Products Sector SIC 3611
Energy Sources in Terajoules per Year (TJ/yr.)



A Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990, 1994 to 1999. Prepared for the Canadian Petroleum Products Institute (CPPI) and the Canadian Industry Program for Energy Conservation (CIPEC) by John Nyboer and Bryn Sadownik, Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), October 2000, Simon Fraser University.

PROFILE Pulp and paper, a key component of the forest products industry, is a major contributor to Canada's economy. Besides pulp, the sector includes the newsprint, paperboard, building board and other paper subsectors. In its 125 plants across Canada, the pulp and paper industry produced 31.4 million tonnes of product in 1999.

PULP AND PAPER

PERFORMANCE HIGHLIGHTS

- The pulp and paper sector's total production rose to 31 410 kilotonnes in 1999.
- Fuel switching, better use of existing equipment, adoption of energy-efficient equipment and processes and the increased use of cogeneration have enabled the industry to move toward its energy efficiency goals.
- Smurfit-Stone Container Canada Inc. put energy efficiency front and centre for a month, as part of its year-long "défis Attitude 2000" awareness program.
- Weyerhaeuser completed a $315-million Waste Wood Low Odour project at its Prince Albert, Saskatchewan, facility in mid-2000.
- Spruce Falls Inc. is the first pulp and paper company in Ontario to achieve ISO 14001 certification.
- Energy-reduction projects at Tembec Industries' Skookumchuck pulp mill have enabled the company to run the mill with a single kraft recovery boiler.
- The Pulp and Paper Technical Association of Canada has published *A Guide to Energy Savings Opportunities in the Kraft Pulp Industry.*
- The pulp and paper industry has improved its energy consumption per tonne of output by 11.2 percent since 1990.

ACTIONS Pulp and paper companies continue to improve energy intensity and implement programs to switch from fossil fuels to biomass. Following are some examples.

Smurfit-Stone Container Canada Inc. put energy efficiency front and centre for a month as part of its year-long "défis Attitude 2000" awareness program. With Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) participating in a special two-day employee awareness event at the company's La Tuque, Quebec, facilities, Smurfit-Stone Container attracted considerable local media attention. CFLM radio broadcast a segment on the OEE–Smurfit-Stone partnership, and local and regional publications picked up the industry energy efficiency story. Response from employees, management and the local community was highly positive.

Weyerhaeuser Canada Ltd. completed a $315-million Waste Wood Low Odour (WWLO) project at its Prince Albert, Saskatchewan, facility in mid-2000. As part of the project, Weyerhaeuser installed a new recovery boiler, converted an existing boiler to burn wood waste and shut down a second recovery boiler and two package boilers. The whole system is run with state-of-the-art control systems and stack monitoring and uses a new wood-waste processing and delivery system. The new systems reduce recovery boiler emissions from as high as 240 ppm (parts per million) to less than 5 ppm and cut particulate emissions to less than 70 mg/m^3. The WWLO project slashes natural gas usage by up to 70 percent and cuts purchased power requirements in half.

Spruce Falls Inc., a Tembec Industries company, is the first pulp and paper company in Ontario to achieve ISO 14001 certification. The certification is a two-and-a-half-year effort that reaffirms Tembec's commitment to continued environmental improvements and responsible management of all natural resources.

Three energy-reduction projects at Tembec Industries' Skookumchuck pulp mill in Cranbrook, British Columbia, have combined to enable the company to shut down its natural gas-fired boiler and run the mill with a single kraft recovery boiler. The projects have reduced the steam needed to heat boiler feedwater by 15 000 lb. per hour and cut the mill's freshwater intake by up to 1000 U.S. gallons per minute. In addition, the mill has substantially reduced its natural gas use and realized savings of $15 per air dry metric tonne.

With the support of NRCan, the Pulp and Paper Technical Association of Canada has published *A Guide to Energy Savings Opportunities in the Kraft Pulp Industry.* The guide gives pulp and paper engineers a practical, step-by-step approach to improving the energy efficiency of kraft mills by using energy audits, benchmarking and the evaluation and implementation of energy-saving ideas.

In addition, *Energy Cost Reduction in the Pulp and Paper Industry* has been published by the Pulp and Paper Research Institute of Canada (Paprican). A three-day seminar based on the monograph has been created for sector companies.

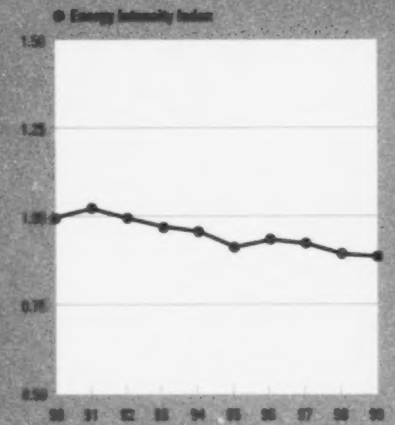
The Pulp and Paper Sector Task Force was strengthened in 2000 when the Quebec Forest Industries Association signed a letter of co-operation with CIPEC.

ACHIEVEMENTS The pulp and paper industry has improved its energy consumption per tonne of output by 11.2 percent since 1990. This achievement is consistent with the industry's commitment of a 1-percent improvement in energy efficiency per year from 1990 to 2000. The sector decreased its total energy consumption per tonne of pulp or paper from 29.5 GJ in 1990 to 26.2 GJ in 1999. Over the same period, the consumption of fossil fuel and electricity (excluding biomass) decreased from 14.2 GJ to 11.8 GJ. The portion of total energy supplied by biomass increased from 50.5 percent in 1990 to 54.0 percent in 1999.

Thanks to an ongoing switch to biomass fuel sources, the pulp and paper industry is reducing its use of less environment-friendly fossil fuel sources, despite growing production. The use of biomass, including wood waste, sludge and pulping liquor, has risen by 23 percent, from 378 200 TJ in 1990 to 464 868 TJ in 1999. Over the same period, the use of heavy fuel oil has been reduced by 39.8 percent. As a result, when biomass energy is excluded, it took 16.9 percent less energy to produce a tonne of pulp and paper in 1999 than it did in 1990. When biomass energy is included, the improvement is 11.2 percent.

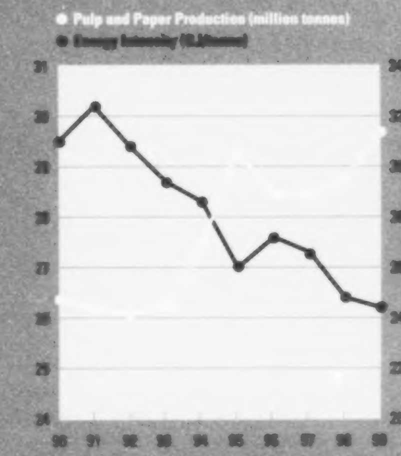
CHALLENGES Fuel switching, especially from fossil fuels to biomass fuels, promises to help the sector achieve additional reductions in energy intensity. However, the availability of wood residues (such as bark, sawdust and wood shavings) is limited in many areas, making transportation costs a significant barrier to greater use of residue surpluses in some parts of Canada. Moreover, production curtailments have led to restrictions on capital spending, creating a serious challenge for companies seeking to further improve energy efficiency and reduce greenhouse gas emissions.

Pulp and Paper Sector SIC 271
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



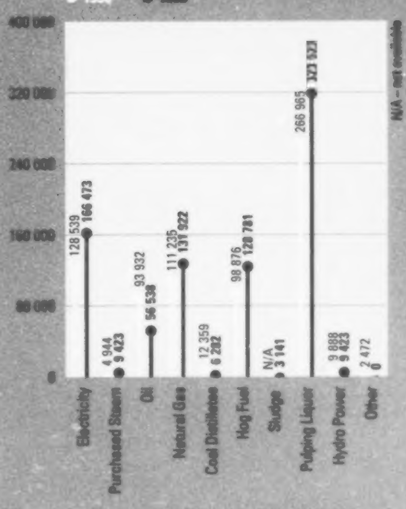
Data source: Forest Products Association of Canada's (formerly the Canadian Pulp and Paper Association) *Energy Monitoring Report*. December 12, 2000.

Pulp and Paper Sector SIC 271
Energy Intensity and Physical Output (1990–1999)



Data source: Forest Products Association of Canada's (formerly the Canadian Pulp and Paper Association) *Energy Monitoring Report*. December 12, 2000.

Pulp and Paper Sector SIC 271
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Forest Products Association of Canada's (formerly the Canadian Pulp and Paper Association) *Energy Monitoring Report*, December 12, 2000.

PROFILE The rubber products industries sector comprises establishments that are primarily engaged in manufacturing tires and tubes, automotive parts, rubber hoses and belting, mechanical rubber goods and a wide variety of other products, such as rubber and plastic weather stripping, pressure-sensitive tape, rubber gloves, rubber mats, rubber household products and tire-retreading materials. To meet demand for its products, the rubber products industry employs just over 26 000 people in some 240 facilities nationwide, providing a total payroll of more than $700 million annually.

RUBBER

PERFORMANCE HIGHLIGHTS

- **The rubber products industry employs just over 26 000 people in some 240 facilities nationwide.**
- **Industry production rose from 531 961 tonnes in 1990 to 1 203 324 tonnes in 1999.**
- **The sector published *Energy Efficiency Opportunities in the Rubber Industry* to help manufacturers cut their energy costs.**
- **The sector developed an industry environmental tracking model to enable plants to benchmark their progress against the industry's.**
- **Despite the increase in energy consumption demanded by increased production and improved air-emissions quality standards, the sector continues to reduce its energy intensity.**

ACTIONS As the rubber industry's national trade association, the Rubber Association of Canada (RAC) plays a crucial role in co-ordinating and focusing the industry's environmental efforts. The rubber sector is made up of large multinational companies operating efficient, modern plants and smaller, locally owned firms that, while generally efficient, do not always have the same benefit of scale available to large multinationals. The ability of smaller, or local, firms to implement energy efficiency measures varies by company. As a result, many of the energy efficiency activities being undertaken in the industry are aimed at these firms, including the following:

- publishing an energy efficiency guidebook aimed at assisting rubber manufacturers to identify opportunities for energy savings within their facilities. Entitled *Energy Efficiency Opportunities in the Rubber Industry*, the guide provides information on quantifying energy costs, energy-consuming equipment, energy-saving tips, energy monitoring and control systems and conversion factors;
- offering energy efficiency workshops to rubber manufacturers;
- conducting workshops to assist manufacturers to gain environmental site approvals; and
- developing an industry environmental tracking model to enable individual plant managers to benchmark their progress against that of the industry.

The RAC sponsors and mounts a biennial, international rubber-recycling forum to foster the development of the commercial rubber-recycling industry – an emerging but fragile new industry. The event, "Rubber Recycling 2000: A World of Opportunity," was held October 11–13, 2000, in Toronto, Ontario. It must be noted, however, that successful rubber recycling is heavily dependent on backdrop legislation in each jurisdiction that supports waste collection and delivery to processors. Hence, local governments must accept responsibility for creating an environment conducive to rubber recycling.

By maintaining the industry's focus on environmental issues, the RAC plays a constructive role in improving energy intensity and reducing greenhouse gas (GHG) emissions.

ACHIEVEMENTS The North American rubber industry has largely rationalized. As a consequence, industry activity tends to be concentrated in larger firms (i.e., 100 or more employees), which account for over 70 percent of total shipments. Coupled with the rationalization has been an ongoing global shake-out and consolidation. For example, in 1999, Dunlop Tire was absorbed by The Goodyear Tire & Rubber Company, and The Standard Products Company became part of Cooper Tire & Rubber Company. In 2000, Thona became part of SaarGummi GmbH of Germany. This activity has led to the closing of older plants and the consolidation of product manufacture within the most efficient operations worldwide.

Because the industry is currently operating at close to full capacity, meeting increased demand may require capital investment, providing an opportunity to introduce additional, new, energy-efficient technologies and processes. However, given the globally rationalized nature of the rubber industry, there is no guarantee that such investment will be made in Canada.

Based on data collected by the Rubber Association of Canada for 1999, total production of the rubber products sector was some 1 203 324 tonnes, with a value of approximately $5 billion, up from 531 961 tonnes and $2.6 billion in 1990. The majority of the total value of shipments were exports, with over 95 percent of these going to the United States.

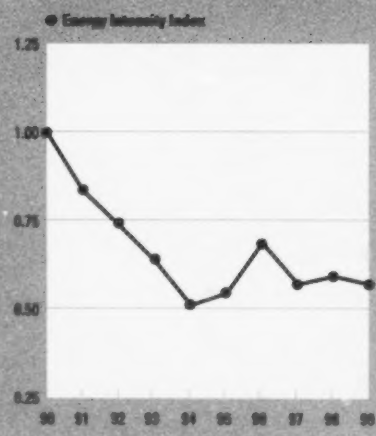
The cost of fuel and electricity for the rubber products sector is approximately 2 percent of shipments. In comparison, total wages were 25 percent of shipments, while the cost of materials and supplies used during production was 54 percent of shipments. Approximately 50 percent of the industry's energy requirements are filled by natural gas, 35 percent by electricity and nearly all of the rest by heavy fuel oil.

In absolute terms, energy consumption for the rubber products industry increased between 1990 and 1999, rising from 9115 TJ in 1990 to 11 794 TJ in 1999. However, the sector's gross output increased at a higher rate, leading to a decline in energy intensity over the same period. The industry kept its energy use to a 24-percent increase over the same period, mainly by increased capital investment in plants and machinery, as well as through an industry-wide trend to continuous seven-day operations. Both of these have had a positive impact on energy efficiency.

CHALLENGES The rubber industry has become increasingly energy efficient since 1990, a trend aided by pressures to reduce production costs and by the impact of consolidation and industry rationalization. Canadian-based subsidiaries of larger multinational firms in the rubber industry operate within a global context, and generally have modern, energy-efficient facilities, with high production capacities. While new capital investment could provide opportunities to lower the energy intensity for the sector, such investment may not be made in Canada. Canadian policy-makers must remain cognizant that, within a globally rationalized industry, investment decisions are generally made after a rigid corporate capital pool analysis of all competing international production jurisdictions. Personal and business taxation play a significant role in the decision-making process.

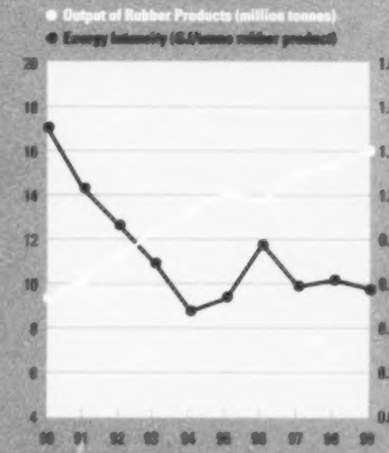
Deepening the challenge are signs that difficult times are ahead for sectors, such as rubber, that are heavily dependent on the North American automotive industry. At a time when shareholder expectations have never been more demanding, Canadian rubber manufacturers are being hit with increasing economic uncertainty, higher costs, lower prices and reduced volumes. Exacerbating the problem, recent and proposed government legislation will add significant cost to rubber tire production. For example, in the United States – the destination for 85 percent of the Canadian industry's production – the National Highway Traffic Safety Administration has promulgated the *Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act*. This Act significantly alters the way tires are marked and has added enormous expense to mould costs. Canadian regulations are harmonized with those in the United States, and there will be similar and parallel action on the part of Transport Canada. At a time when the industry faces the pressures of shareholder expectations, market uncertainty, increased energy and raw-material costs and declining margins, it will also face significant additional regulatory overhead.

Rubber Sector SIC 15
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



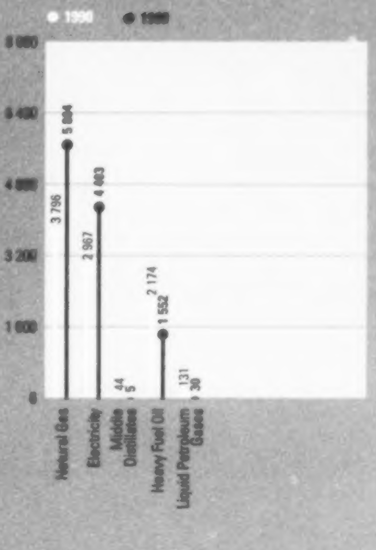
Data source: 1990 and 1996 to 1999, Rubber Association of Canada (RAC), 2001. Years 1991 to 1995, RAC, 2000.

Rubber Sector SIC 15
Energy Intensity and Physical Output (1990–1999)



Data source: 1990 and 1996 to 1999, Rubber Association of Canada (RAC), 2001; 1991 to 1995, RAC, 2000.

Rubber Sector SIC 15
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: 1990 and 1996 to 1999, Rubber Association of Canada (RAC), 2001; 1991 to 1995, RAC, 2000.

PROFILE: Canada's steel sector is one of the country's largest industries, generating sales of more than $11 billion, including $3.6 billion in exports in 1999. The industry includes 17 plants that directly employ 34 500 workers. The companies that make up the steel sector supply flat-rolled (sheet and plate), long (re-bar and structural steel) and specialty and alloy (stainless and tool steels) products for major markets, including transportation, oil and gas, appliances, packaging and construction. Facilities are found in six provinces, with Ontario accounting for 70 percent of Canadian steel production.

STEEL

PERFORMANCE HIGHLIGHTS

- **The steel industry includes 17 plants that melt and pour steel, directly employing 34 500 workers.**
- **The industry registered strong performance in shipments, sales and exports in 1999.**
- **Since 1990, the industry has achieved an 18.2-percent improvement in energy consumed per tonne shipped.**
- **The sector's average annual energy efficiency improvement is 2 percent, surpassing the industry's commitment of 1 percent per year.**
- **Lake Erie Steel was a winner in Canada's Energy Efficiency Awards 2000 for its "Air Separation Plant Powered With By-Product Fuel" project.**
- **The industry now uses about 30 percent less energy per tonne than it did in the early 1980s and is producing superior products at significantly lower prices.**

ACTIONS Canadian steelmakers continued to emphasize energy efficiency as a major thrust of productivity, quality and cost-reduction efforts in 1999 and 2000.

Atlas Specialty Steels (Division of Atlas Steel Inc.) of Welland, Ontario, introduced a number of measures to improve energy efficiency. The company outfitted table drives with variable frequency control, installed a new Car Bottom reheat furnace and upgraded car furnaces. Atlas also replaced ladle heaters to improve temperature control, upgraded plant lighting and installed an automated Bar Cell in its finishing department.

Dofasco Inc. of Hamilton, Ontario, initiated measures to reduce steam consumption in its coke-making plants. The company metered operations in two of its coke plants and refreshed a steam-trap program to monitor, identify and replace faulty traps throughout the business unit. Steam efficiency was improved by modifying the exhausters that are used to remove gas from coke ovens. Dofasco has also set an internal energy efficiency improvement goal for business-planning purposes.

Stelco-McMaster Ltée of Contrecoeur, Quebec, modernized its bar mill by replacing the rolling mill and installing high-efficiency electric motors. The new bar mill will enable the company to improve off-gas post-combustion in the plant's EBT furnace.

Gerdau Courtice Steel Inc. of Cambridge, Ontario, has added oxy-fuel burners to its electric arc furnaces to reduce power consumption and improve furnace efficiency.

QIT - Fer et Titane Inc. of Tracy, Quebec, installed new burner controls to improve combustion efficiency and increase control in ladle preheating.

Sydney Steel Corporation of Sydney, Nova Scotia, introduced a plant-wide program to reduce non-process power consumption, achieving a 20-percent reduction in electrical use.

AltaSteel Ltd. of Edmonton, Alberta, has installed energy-efficient motors and converted office lighting to high-efficiency fluorescent ballasts and tubes. In 2001, the company will begin phase one of a bar mill upgrade that will significantly improve productivity and reduce yield losses.

Stelco's Hilton Works in Hamilton, Ontario, uses waste heat and by-product fuels to produce a large percentage of its process steam. Reheat furnace skid-pipe heat loss is minimized with added insulation, while new controls precisely measure and control fuel and combustion airflow. The company is in the process of replacing natural gas furnace cooling with nitrogen top cooling, and installing new control instrumentation on the hot strip mill and plate mill furnaces.

Lake Erie Steel Company Ltd. of Nanticoke, Ontario, completed an upgrade of its boiler controls and construction of a high-efficiency reheat furnace.

ACHIEVEMENTS The Canadian steel industry registered strong performance in shipments, sales and exports once again in 1999. During the year, the industry produced 16.1 million tonnes of steel and shipped 15.0 million tonnes. However, due to weakening economic conditions for the industry, this trend did not continue through 2000.

Since 1990, the industry has achieved an 18.2-percent improvement in energy consumed per tonne shipped. The average annual energy efficiency improvement was 2.0 percent, surpassing the industry's commitment of 1.0 percent per year to 2000 from the adjusted 1990 rate of 21.18 GJ per tonne shipped. In addition, the trend toward less carbon-intensive energy use in the industry has meant that 1999's overall CO_2 emissions were 9.0 percent below adjusted 1990 levels.

Within the industry, over 90 percent of companies representing more than 90 percent of production have made voluntary, corporate energy efficiency improvement commitments through a number of initiatives. These include the Industrial Energy Innovators Initiative, Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) and ÉcoGESte. The Steel Sector Task Force is confident that, between 2000 and 2010, the Canadian steel industry will improve energy intensity by an average 1 percent per year compared with the 2000 base year. Achieving this target will enable the sector to record an equivalent improvement in energy consumption per tonne shipped of 1.6 percent per year over the 20-year period from 1990.

Lake Erie Steel Co. of Nanticoke, Ontario, was a winner in Canada's Energy Efficiency Awards 2000 for its "Air Separation Plant Powered With By-Product Fuel" project. Lake Erie Steel is using waste steam generated from blast furnace gas to power compressors in the smelter's cryogenic air separation plant. As a result of this creative approach, the company has reduced its electricity costs by about $1.7 million annually and achieved significant, enduring environmental benefits.

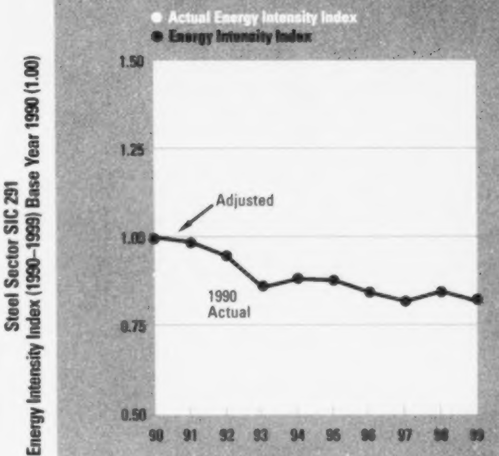
CHALLENGES Steelmakers must improve productivity in step with, or ahead of, their competitors to hold on to their customers, attract investment capital and sustain well-paid jobs. In the face of increasing global competition, they must reduce costs while still delivering higher-value products to their customers.

The steel industry has responded to these challenges with innovation, new technology and substantial capital investments. As a result, the industry now uses less energy per tonne than it did in the early 1980s, producing superior products at significantly lower prices. Despite these successes, maintaining and improving productivity remains a deepening challenge for the industry.

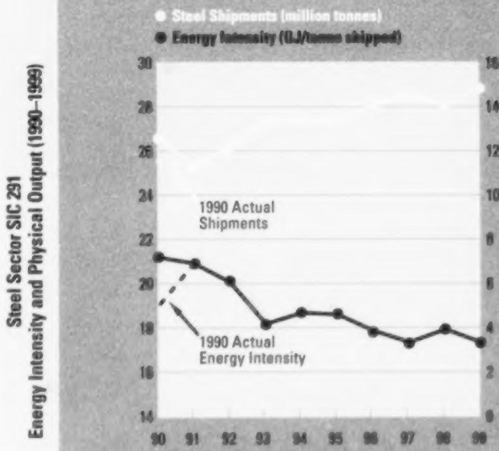
Pressures on productivity, efficiency and competitiveness have been exacerbated by trends in international trade. Canadian producers must not only compete for the North American market share with U.S. mills, but also meet the added pressures of steel imports from abroad. With worldwide steel production running ahead of international markets, offshore producers have turned to a strong North American market for sales, often at prices below the cost of production. This severely strains the ability of North American producers to compete, forces production cutbacks and limits the capital available for energy efficiency activities.

The impact of import competition has been exacerbated by rapidly rising energy prices. Over the past two years, natural gas prices have escalated dramatically. With natural gas supplying 34 percent of the industry's energy, the benefits of the industry's dramatic gains in energy efficiency have been offset by higher energy costs, further reducing the funds available for investment.

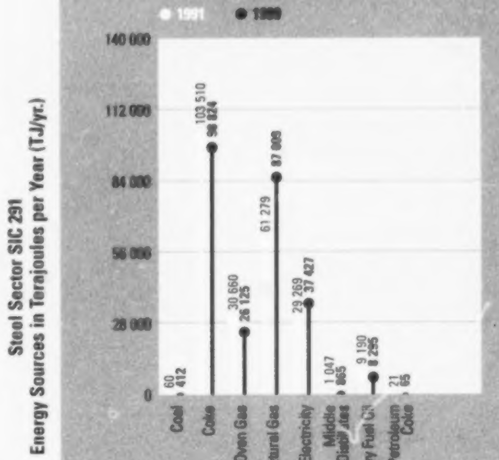
The Canadian steel industry continues to support liberalized trade and open markets on a level international playing field. However, with many international suppliers based in low-wage countries not covered by the Kyoto Protocol and with emerging countries maintaining government-supported excess capacity, it is a challenge to ensure effective tools are in place to prevent unfairly traded imports. Establishing a level playing field will take a higher degree of co-operation and commitment from governments around the world than is currently being demonstrated. Until then, strong action is needed by both the industry and government to ensure that all producers selling into Canadian markets are competing on an even footing.



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand*, February 2001.



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand*, February 2001



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand*, February 2001.

PROFILE: Canada's textiles sector produces the fibres, yarns and fabrics used in industries as diverse as automotive manufacturing, clothing, construction, environmental protection and road building. The textiles sector is organized into three subgroups – primary textiles, textile products and motor vehicle fabric accessories. Together, the industry sells to 150 markets around the world, exporting 33 percent of its production.

TEXTILES

PERFORMANCE HIGHLIGHTS

- Canada's textile industry sells to 150 markets and exports over 33 percent of its production.
- In 1999, the industry GDP output was 26 percent higher than in 1990, while its energy consumption increased by only 11 percent.
- The sector's energy mix continues to shift from hydrocarbon sources to electricity.
- Investment in new technology by Manoir Inc. has reduced its water consumption in dyeing and finishing to one of the lowest rates in the North American textile industry.
- St. Lawrence Corporation has reduced its 1999 energy usage per kilogram of product to 74 percent of 1990 levels.

ACTIONS A number of companies have added their names to the textiles sector's list of Industrial Energy Innovators in 2000, including the following: Bennett Fleet Inc., Vanier, Quebec; Manoir Inc., Saint-Laurent, Quebec; and Monterey Textiles 1996 Inc., Drummondville, Quebec.

Throughout the sector, companies are benefiting from more efficient uses of energy. Manoir Inc., Saint-Laurent, Quebec, operates a dyeing and finishing plant that processes 3 million kilograms of fabric each year. The company has implemented a sustained water-conservation program that has reduced its water consumption to 64.6 litres per kilogram of dyed product, saving 140 000 m^3 of water per year. Manoir's water consumption for dyeing and finishing operations is now among the lowest in the North American textile industry. In May 2000, Manoir's achievement earned a Biosphère prize from Environment Canada and the Montréal Urban Community.

By the end of 1999, St. Lawrence Corporation, Iroquois, Ontario, had reduced energy usage per kilogram of product to 74 percent of 1990 levels. Installation of a new Wash Range resulted in an 18-percent reduction in water consumption. New weaving machines resulted in an energy saving of 38 percent per kilogram of product. St. Lawrence Corporation has also published three pamphlets as part of its employee awareness program. The pamphlets emphasize the company's commitment to greenhouse gas (GHG) reduction, describe the company's action plan and explain climate change and its importance for Canadians.

DuPont Canada Inc. replaced older equipment with a new High Temperature Heat Transfer Fluid Vaporizer. The unit has a heat efficiency 20 percent greater than the equipment it replaced, resulting in a savings of 20.4 TJ per year, with a corresponding reduction in natural gas use and GHG emissions. By the end of 1999, total energy use per unit of production at DuPont Canada Inc. was 28 percent lower than it was in 1990. This compares well to the company's goal of a 25-percent reduction between 1990 and 2000 and a further 15-percent reduction by 2005. While total production in 1999 was 9.4 percent ahead of 1998, absolute energy usage was up by only 2.2 percent, and energy usage per unit of production was down by 6.8 percent.

In 2000, DuPont Canada Inc. signed a Master Energy Services Agreement with AGRA-Cogenex to carry out energy performance contracts in all of DuPont Canada's facilities. Energy-conservation projects worth about $16 million are being studied in the first phase of this project.

In 2000, the Textiles Sector Task Force confirmed the comprehensive action plan introduced in 1997 and agreed to concentrate on two principal goals: to broaden the participation of textile manufacturers in the Industrial Energy Innovators Initiative and Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) and to strengthen the commitment of existing Industrial Energy Innovators. Manufacturers participating in the task force have agreed to demonstrate, by example, the economic benefits that flow from effective energy efficiency programs. Moreover, task force members remain committed to following up directly and personally with the sector's Industrial Energy Innovators to review their progress in fulfilling their commitment.

The industry is continuing its own survey to identify and correct inconsistencies and errors in the textiles sector data currently available in government reports. More accurate information will enable the industry to establish better measures of success in meeting energy efficiency targets. In addition to the industry's own data-gathering activities, the Canadian Textiles Institute is providing a fourth year of financial support to the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University.

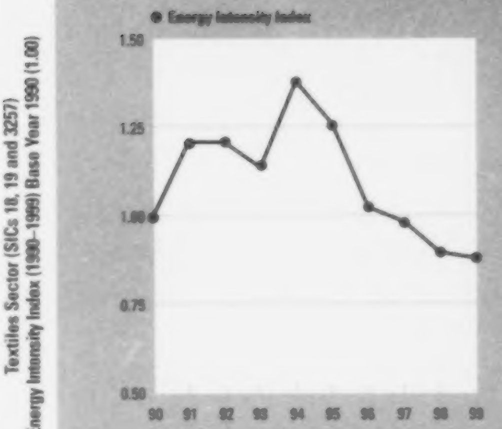
ACHIEVEMENTS The textiles sector's energy usage continues to shift from hydrocarbon sources to electricity. Natural gas use has declined from 64 percent of total energy consumption in 1990 to 48 percent in 1999. Consumption of other hydrocarbon fuels declined from 8 percent in 1990 to 5 percent in 1999. Electricity's share rose from 28 percent in 1990 to 38 percent in 1999.

As a result of the industry's efforts to improve the accuracy of reporting by individual companies, Statistics Canada's 1999 data more accurately reflect the industry's experience. While the industry's GDP output in 1999 was 26 percent higher than in 1990, its total energy consumption increased by only 11 percent.

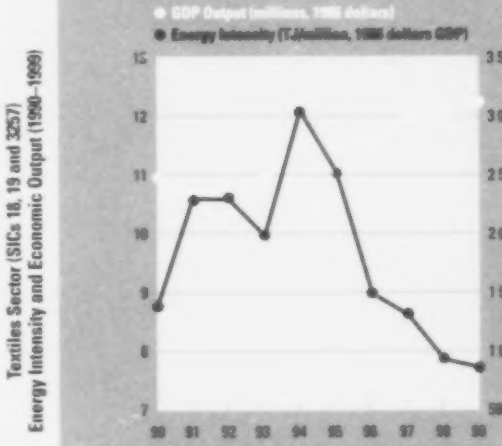
In August 1999, the Textiles Sector Task Force committed the industry to a new energy intensity target of 1 percent per year for the period 2000–2010. Efforts in the coming years will build on the sector's improved energy efficiency performance since 1995 and reflect ongoing consultations to meet Canada's Kyoto commitments.

CHALLENGES The task force believes that a key challenge is to gain the active involvement of more of the industry's major producers as Industrial Energy Innovators. Toward that end, task force members continue to lead in efforts to broaden participation.

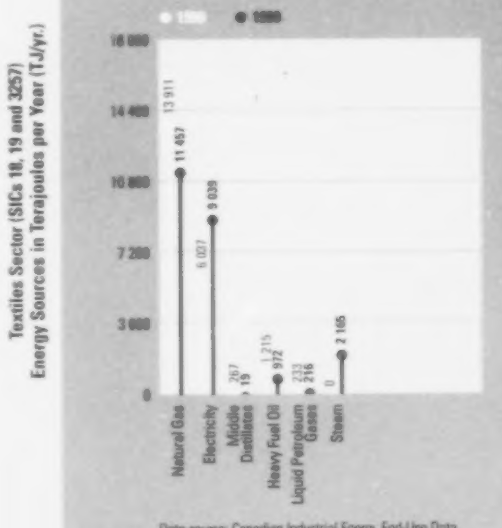
Along with developing methods to measure energy use more accurately, increased efforts are required to sensitize those in the textile industry to the long-term implications of Canada's Kyoto commitments and to encourage active participation in the new national implementation strategy for energy efficiency. During 2000, the Textiles Sector Task Force and the Canadian Textiles Institute have devoted time and resources to these challenges. To achieve success, these efforts must be intensified.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE The Canadian transportation equipment manufacturing sector includes the manufacturing of aircraft, aircraft parts, automobiles, motor vehicle parts, trucks, buses, trailers and military vehicles, as well as railroad rolling stock, ships and pleasure boats. The sector is a major part of the Canadian economy, accounting for nearly 3 percent of Canada's GDP and over 15 percent of the total manufacturing GDP in 1999. Including dealer, parts and distribution networks, the sector employs more than half a million people across Canada.

TRANSPORTATION EQUIPMENT MANUFACTURING

PERFORMANCE HIGHLIGHTS

- Transportation equipment manufacturing accounted for nearly 3 percent of Canada's GDP and over 15 percent of the total manufacturing GDP in 1999.
- Task force members assisted the Transportation Equipment Manufacturing Sector Working Group of the National Climate Change Industry Table to formulate the sector's "Foundation and Technology Assessment Reports."
- General Motors of Canada Limited implemented energy efficiency projects in 1999 that resulted in savings of more than $1.4 million.
- An oven upgrade at Ford of Canada's Windsor Casting Plant reduced annual natural gas usage by over 101 000 GJ, at a cost savings of over $1 million.
- DaimlerChrysler now uses direct condensor water for cooling in the electrocoat painting process at its Pillette Road Truck Assembly Plant, saving more than 750 000 kWh and reducing annual costs by $45,000.
- By the end of 1999, the sector achieved an overall improvement in energy intensity of 17.8 percent, compared with 1990 levels.

ACTIONS The CIPEC Transportation Manufacturing Sector Task Force includes representatives of automotive, automotive parts and aircraft manufacturers, as well as utilities and Natural Resources Canada's Office of Energy Efficiency. The task force is seeking to expand the sector's coverage to include rail and marine manufacturers.

The task force continued its tradition of promoting energy efficiency at its fourth annual "One-Day Energy Conference" held in September 1999 at Husky Injection Molding Systems Ltd. in Bolton, Ontario. The conference included the presentation of energy success stories within the automotive and parts industry, as well as updates on climate change and CIPEC/Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.). The day finished with a tour of the Husky facility. The task force currently plans to hold its next annual energy conference in the first quarter of 2001 at General Motors in Oshawa, Ontario.

During 2000, the task force wrote to all Industry Energy Innovators in the transportation equipment manufacturing sector, encouraging them to submit progress reports to CIPEC and VCR Inc. on energy efficiency improvements. Task force members also assisted the Transportation Equipment Manufacturing Sector Working Group of the National Climate Change Industry Table to formulate the sector's "Foundation and Technology Assessment Reports."

The task force met on a monthly basis during the year to receive energy efficiency updates and to develop conferences and outreach programs to encourage others to join. Enbridge Consumers Gas joined the task force in 2000 and has been a welcome addition. Individual sector members have made significant advances in energy efficiency. Following are some examples.

- General Motors of Canada Limited implemented energy efficiency projects in 1999 that resulted in savings of more than $1.4 million. These projects included improvements to heating and ventilation, manufacturing processes and compressed-air systems, along with the installation of high-efficiency lighting and new energy-management practices. One project, a modification project for the dust collector controls at the Oshawa, Ontario, body plant, reduced annual electrical energy usage by 41 000 000 kWh.
- The Ford Motor Company of Canada, Limited's Windsor Casting Plant in Ontario upgraded its heat treat gas oven and dryer controls. The result is a reduction in natural gas usage of over 101 000 GJ and a cost savings of over $1 million.
- Process modifications enabled DaimlerChrysler Corporation to phase out the 130-tonne capacity electrocoat CFC chillers at its Pillette Road Truck Assembly Plant. Direct condenser water now fills the cooling needs of the electrocoat painting process, saving the company more than 750 000 kWh and reducing annual costs by $45,000.

- An engineering student, under the guidance of the Automotive Parts Manufacturers Association, led an Energy Resources Management System pilot program at Polycon Industries in Guelph, Ontario. The program helped to identify opportunities for energy savings and ways to minimize maintenance costs.

ACHIEVEMENTS Although a robust economy in 1999 added 18 percent to the value of the total output of the transportation equipment manufacturing sector, energy usage remained surprisingly close to that of 1998. In 1999, the sector consumed 68 342 TJ of energy, up 30 percent since 1990. Over the same period, gross output increased by 70 percent, leading to an overall improvement in energy intensity of 17.8 percent compared with 1990 levels. Overall energy use by the sector is 2.8 percent of the total for all industries in Canada. Within the sector, the largest energy users are motor vehicle assembly plants and automotive parts facilities, which account for 41 percent and 38 percent of energy consumption, respectively.

Energy use by fuel type has remained fairly constant since 1990, with natural gas (56 percent) and electricity (36 percent) making up the bulk of the energy used. Liquid petroleum gases, middle distillates (No. 2 fuel oil), heavy fuel oil and coal use have continued to decline since 1990. However, with the continuing price escalation of natural gas, this trend may soon reverse.

Over the long term, the sector expects to grow an average of 1.5 percent per year. While motor vehicle manufacturing will grow at a relatively modest pace, reflecting the mature state of the North American automotive market, the Canadian production of automotive parts should grow at a considerably faster pace. This reflects lower labour costs and other trends that increasingly favour Canadian sourcing of automotive parts.

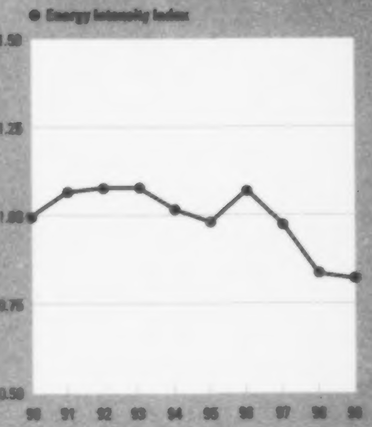
CHALLENGES The transportation equipment manufacturing sector is committed to continuously improving quality, environmental performance and energy efficiency. Energy-efficient equipment is being installed wherever feasible, but investment payback requirements of less than two years and internal competition for funds are challenging energy managers who are seeking to make major gains. Moreover, energy efficiency improvements arising from the implementation of new technology are likely to be offset by trends that are driving energy use higher. These trends include the increased use of cooling to improve working conditions, more demanding pollution control and shifts to more energy-intensive products and processes.

Unless there are major breakthroughs in technology, energy efficiency improvements in the transportation equipment manufacturing sector are likely to come in small increments. Moreover, since the sector is already an efficient energy user, there are relatively few cost-effective opportunities for dramatic gains. Cogeneration represents the single biggest opportunity for energy efficiency improvement, but not all industry facilities are well suited to its use, and current uncertain economic conditions limit the ability of manufacturers to commit to such investments.

These challenges notwithstanding, the sector continues to take strong action to reduce greenhouse gas emissions. The 1990 base year was a low production year for the sector. Since then, economic recovery combined with industrial growth has caused emissions to increase by 30 percent to the end of 1999, despite the sector's best efforts. It is improbable that the sector will meet a sector-specific target that parallels Canada's overall Kyoto commitment to reduce overall emissions by 6 percent from 1990 levels.

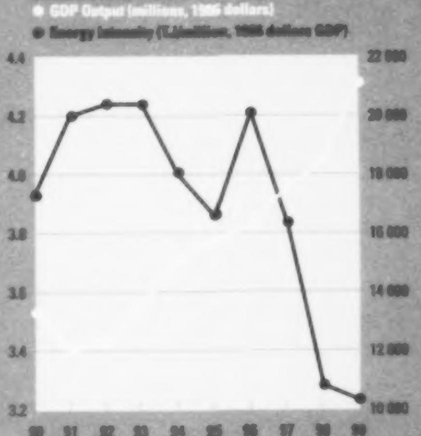
The transportation equipment manufacturing sector continues to support a goal of 1-percent-energy-per-unit reductions per year through the year 2005. The sector will support efforts to reach this goal by holding an energy conference in the first quarter of 2001 and by encouraging auto parts suppliers to join the Industrial Energy Innovators Initiative. Sector companies will continue to submit action plans to VCR Inc. In addition, the task force will seek additional representation, including rail and marine manufacturers, along with electrical utilities.

Transportation Equipment Manufacturing Sector SIC 32
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



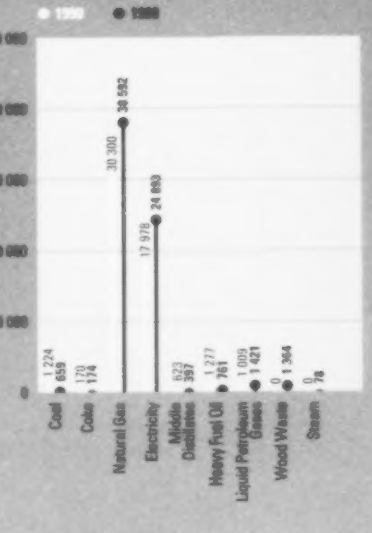
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Transportation Equipment Manufacturing Sector SIC 32
Energy Intensity and Economic Output (1990–1999)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

Transportation Equipment Manufacturing Sector SIC 32
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* October 27, 2000, Simon Fraser University.

PROFILE The wood products industry consists of nearly 3000 establishments across Canada employing just under 20 000 workers. The sector includes sawmills, planing mills and shingle mills that manufacture products ranging from timber to finished lumber for domestic and world markets.

WOOD PRODUCTS

PERFORMANCE HIGHLIGHTS

- **Canfor Corporation, based in Vancouver, British Columbia, is turning wood waste into useful products.**
- **Nexfor Inc.'s cogeneration facility in Edmundston, New Brunswick, has reduced fuel costs by 75 percent.**
- **Abitibi-Consolidated invested $7.45 million to modernize its Senneterre, Quebec, sawmill.**
- **Domtar Inc. is completing a $130-million investment program at its Quebec and Ontario sawmills to increase efficiency and raw material utilization.**
- **Buchanan Lumber spends millions of dollars each year to research and implement new technologies.**
- **Fuel switching to biomass energy sources remains a major industry focus as companies seek to reduce production costs and improve their energy efficiency.**

ACTIONS Forest product companies continue to make investments which improve their utilization of raw materials and energy efficiency. For example, Vancouver, British Columbia-based Canfor Corporation is diverting wood waste to make useful products. At its Chetwynd, British Columbia, mill, the company uses 66 000 BDt (bone-dry tonnes) of previously burned whitewood each year to produce pulp. At its Polar, British Columbia, sawmill, a $5.4-million investment now enables the company to truck approximately 28 000 BDt of whitewood per year to a sawdust digester, reducing Canfor's biomass fuel greenhouse gas (GHG) emissions by an estimated 146 kilotonnes per year. Canfor also installed a merchandiser to increase the amount of usable solid wood received from the wood residue generated at its Beaver Cove dryland sort on Vancouver Island. Canfor estimates that 20 percent of the approximately 6800 BDt per year of wood residue produced at the dryland sort is now recovered instead of incinerated. These efforts will enable Canfor to achieve a 9.6-percent reduction in GHG emissions by the end of 2000.

A cogeneration facility at Nexfor Inc.'s Edmundston, New Brunswick, plant has reduced fuel costs by 75 percent by replacing fossil fuels with wood waste. In 1998, the company reduced its GHG emissions by 23.1 percent from 1990 levels, through energy efficiency projects and by replacing fossil fuel with biomass. Despite doubling production between 1990 and 1998, the company's fossil fuel energy use has remained constant.

Abitibi-Consolidated Inc. invested $7.45 million to modernize its Senneterre, Quebec, sawmill. Completed in 1999, the upgrade makes the company's Senneterre mill more competitive by increasing productivity and recovery and reducing production costs. The project has increased the sawmill's annual production, while reducing its chip output, by approximately 15 percent, thanks to more efficient use of raw material.

Domtar Inc. is in the middle of a three-year, $130-million investment program at its Quebec and Ontario sawmills to increase efficiency and raw material utilization. The program will enable the company to produce more lumber and develop new value-added products, without increasing the harvesting of forest resources. Domtar has already succeeded in improving its fibre recovery rate by 11 percent in 1999 and hopes to do as much in 2000 and the coming years.

Buchanan Lumber of High Prairie, Alberta, spends millions of dollars each year to research and implement new technologies. The company's goal is to utilize as much fibre as possible out of each tree. The pursuit of that goal has led the company to install a new 6-in. double cut band mill to improve cutting accuracy and production. Buchanan Lumber also constructed a finger jointing plant, which allows the mill to take below-average quality inventory and convert it into high-grade and specialty products, recovering approximately 20 million board feet of product per year. The company has also instituted a pre-sorting program that enables it to kiln dry lumber in batches of similar moisture content. This improves the company's drying curve, saves energy and delivers a more consistent final product.

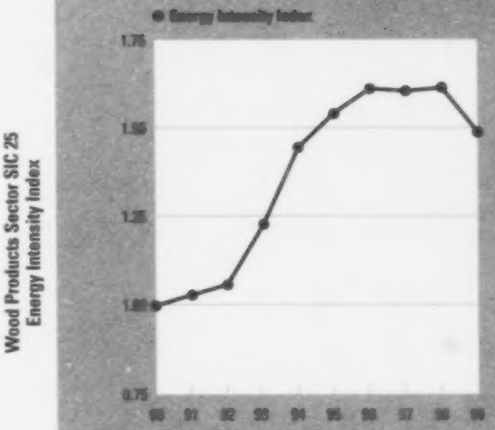
ACHIEVEMENTS The wood products sector consumed 72 263 TJ of fossil fuels and electricity in 1999. Due to strong demand for the industry's products, production has risen 30 percent over the last decade. In turn, this has led to a rise in the total energy consumed by the sector over the same period. However, energy intensity has improved over the last five years.

Rapidly rising energy prices are providing additional incentive for sector companies to implement low-cost energy efficiency measures. The industry continues to look for ways to employ cost-effective biomass energy sources to replace natural gas and electricity. However, adverse national and international economic factors continue to affect both production and energy efficiency efforts and are forcing companies to increase their focus on marketing and product improvement. This trend often leads to greater energy consumption for such measures as kiln drying.

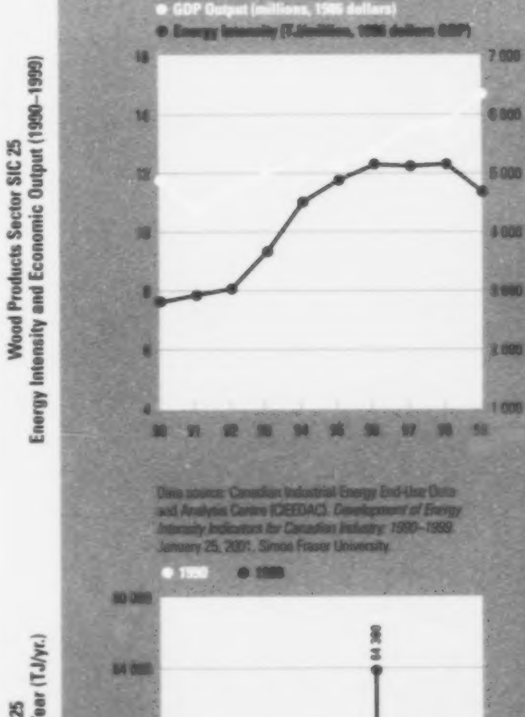
CHALLENGES Establishing meaningful data for the wood products sector is a complicated task. The breadth of products produced by the sector (everything from low-energy intensity shingles to energy-intensive structural products such as new, high-tech-oriented strand boards) makes it difficult to develop meaningful comparisons. Moreover, before 1995, the sector's wood waste for energy use had been attributed to the closely allied pulp and paper industry.

In 1995, energy data collection was refined to differentiate the wood waste used by each sector. While this has resulted in more accurate data for each sector, it has made 1990 an inappropriate base year for current comparisons. Furthermore, many energy efficiency efforts in this sector, such as wood waste cogeneration, are integrated with the pulp and paper sector, making it difficult to segregate energy data.

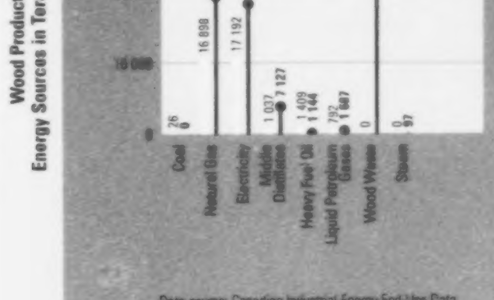
The sector has been working to overcome these issues, and refinements in energy data collection have increased the ability to track the use, not only of purchased energy, but also of internally generated energy. This improves the knowledge of energy use by the wood products sector and has implications for other industrial sectors.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 25, 2001, Simon Fraser University



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 25, 2001, Simon Fraser University



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–1999.* January 25, 2001, Simon Fraser University

Through Natural Resources Canada's Office of Energy Efficiency (OEE), the Industrial Energy Innovators Initiative focuses on transforming the sector-level commitments made by the task forces into company-level action by helping to overcome obstacles to energy efficiency at the company level.

As of April 1, 2001, 294 manufacturing and mining companies – representing approximately 80 percent of industrial energy use – have signed on as Industrial Energy Innovators. The majority of these companies are participants in VCR Inc. For information on becoming an Industrial Energy Innovator, contact the OEE by e-mail at cipec.peeic@nrcan.gc.ca.

INDUSTRIAL ENERGY INNOVATORS

Aluminum

Alcan Aluminium Ltd.
Aluminerie Alouette Inc.
Aluminerie de Bécancour Inc.
Aluminerie Lauralco Inc.
Canadian Reynolds Metals Company Limited

Cement

Blue Circle Cement
ESSROC Canada Inc.
Inland Cement Limited
Lafarge Canada Inc.
North Star Cement Ltd.
St. Lawrence Cement Inc.
Tilbury Cement Ltd.

Chemicals

Chinook Group Limited - Sombra Plant
Degussa-Hüls Canada Inc.
DuPont Canada Inc.
Elementis Pigments Canada
MDS Nordion Inc.
Nacan Products Limited
NOVA Chemicals Corporation
OxyVinyls Canada Inc.
Synergistics Industries Limited

Electrical and Electronics

ASCOlectric Ltd.
Broan-NuTone Canada
Camco Inc.
Honeywell Limited
IBM Canada Ltd.
Nortel (Northern Telecom Limited)
Osram Sylvania Ltd.
Siemens - Technologies du Bâtiment Ltée - Landis Division
Vansco Electronics Ltd.

Food and Beverage

Alberta Processing Co., A Division of West Coast Reduction Ltd.
Andrés Wines Ltd.
API Grain Processors
Armstrong Cheese Company Ltd. - Alberta
Big Rock Brewery Ltd.
Black Velvet Distilling Co.
Borden Foods Canada
Canada West Foods J.V. Inc.
Canamera Foods
Canbra Foods Ltd.
Canyon Creek Soup Company Ltd.
Cargill Animal Nutrition - Camrose Plant
Cargill Animal Nutrition - Lethbridge Plant
Casco Inc.
Champion Petfoods
Coca-Cola Bottling Ltd.
Cuddy Food Products
Family Muffins & Desserts Inc.
Fletcher's Fine Foods
Foothills Creamery
Garden Province Meats Inc.
H.J. Heinz Company of Canada Ltd.
Heritage Frozen Foods Ltd.
Hub Meat Packers Ltd. - Sunrise Brand
Kraft Canada Inc.
Labatt Breweries of Canada
Legal Alfalfa Products Ltd.
Lilydale Cooperative Ltd.
Lone Pine Cheese Ltd.
Maple Leaf Consumer Foods
Maple Leaf Pork - Alberta
Maple Leaf Pork - Ontario
Maple Lodge Farms Ltd.
McCain Foods (Canada) - Alberta, A Division of McCain Foods Limited
Molson Breweries - Edmonton Brewery
Molson Canada - Ontario
Moosehead Breweries Ltd.
Nestlé Canada Inc.
Northern Alberta Processing Co., A Division of West Coast Reduction Ltd.
Parmalat Canada Ltd. - Alberta
Pepsi-Cola Canada Beverages
Prairie Mushrooms (1992) Ltd.
Principality Foods Ltd.
Quality Fast Foods
Sakai Spice (Canada) Corporation
Sleeman Brewing and Malting Co. Ltd.
Sunrise Bakery Ltd.
Sun-Rype Products Ltd.
Transfeeder Inc.
Trochu Meat Processors
Unifeed Premix
Versacold Corporation
Westcan Malting Ltd.
Westglen Milling Ltd.
Weston Foods Inc.

Foundry

Ancast Industries Ltd.
Crowe Foundry Limited
Diversa Cast Manufacturing (A Division of Comtech Mfg. Ltd.)
ESCO Limited - Port Hope Operations
Eureka Foundry Corporation (A Subsidiary of ACI Canada Inc.)
Gamma Foundries Limited
Grenville Castings Limited
Wabi Iron & Steel Corporation
Wescast Industries Inc.

General Manufacturing

3M Canada Inc.
ABCO Property Management Inc.
Canadian Uniform Limited
Champion Feed Services Ltd.
Coyle & Greer Awards Canada Ltd.
Crown Cork & Seal Canada Inc.
EMCO Limited - Building Products
Envirogard Products Ltd.
Escalator Handrail Company Inc.
Euclid-Hitachi Heavy Equipment Ltd.

Federated Co-operatives Limited
Ferraz Shawmut Canada Inc.
Fibrex Insulations, Inc.
Garland Commercial Ranges Limited
Greif Containers Inc.
Imperial Home Decor Group Canada Inc.
Imperial Tobacco Canada Limited
Interface Flooring Systems (Canada) Ltd.
International Paper Industries Ltd.
Jones Packaging Inc.
Kindred Industries
Kodak Canada Inc.
LePage (Division of Henkel Canada Limited)
Maksteel Service Centre (Division of Makagon Industries Ltd.)
Marcel Lauzon Inc.
Metroland Printing, Publishing & Distributing Ltd.
Owens Corning Canada – Toronto Plant
Polytainers Inc.
PRO-ECO Limited
Regent Eco Canada
Rohm and Haas Canada Inc.
S.C. Johnson and Son, Limited
Sandvik Tamrock Canada Inc.
Sandvik Tamrock Loaders Inc.
Scapa Tapes North America
Simmons Canada Inc.
Soprema Inc. – Drummondville Plant
Superior Radiant Products Ltd.
Teknion Furniture Systems Inc.
VicWest Steel
Viskase Canada Inc.
Wabash Alloys Ontario
Wyeth-Ayerst Canada Inc.

Lime

Beachville Lime Limited
Chemical Lime Company of Canada Inc.
Dundas Lime Limited
Graymont (NB) Inc.
Graymont (QC) Inc.
Graymont Western Canada Inc.
Northern Lime Limited

Mining

Aur Resources Inc.
Barrick Gold Corporation – La Mine Doyon (Division of Cambior Inc.)
BHP Diamonds Inc.
Boliden Limited
Canadian Electrolytic Zinc Limited
Cominco Ltd.
Echo Bay Mines Ltd. – Lupin Operation
Falconbridge Limited
Fonderie Horne – Métallurgie Noranda inc.
Hillsborough Resources Limited
Hudson Bay Mining & Smelting Co., Ltd.
INCO Limited
International Minerals and Chemicals (Canada) Global Limited (IMC Kalium Canada Ltd.)
Iron Ore Company of Canada
Mines et exploration Noranda inc. – Division Matagami
Mines Wabush (gérées par la Compagnie Minière Cliffs inc.)
Newmont Canada Limited, Golden Giant Mine
Noranda Inc. – Brunswick Mining Division
Noranda Inc. – Brunswick Smelter
Noranda Metallurgy Inc. – Canadian Copper Refinery
Placer Dome Canada Limited
Quebec Cartier Mining Company
Syncrude Canada Ltd.
Teck Corporation

Petroleum Products

Amoco Canada Petroleum Company Limited
Canadian Tire Petroleum
Chevron Canada Limited – Burnaby Refinery
Enbridge Pipelines Inc.
Husky Oil Operations Ltd.
Imperial Oil Limited
Irving Oil Limited
Nova Corporation
Parkland Refining Ltd.
Petro-Canada
Safety-Kleen Corp.
Shell Canada Products Limited
Suncor Energy Inc.-Sunoco Group
Ultramar Ltd. – Saint-Romuald Refinery

Plastics

Downeast Plastics Ltd.
Husky Injection Molding Systems Ltd.
The Clorox Company of Canada, Ltd.

Potash

Potash Corp. of Saskatchewan Inc.
- Allan Division
- Cory Division
- Lanigan Division
- New Brunswick Division
- Patience Lake Division
- Rocanville Division

Pulp and Paper/Forestry

Abitibi-Consolidated Inc.
Bowater Pulp and Paper Canada Inc.
Canfor Corporation
Cariboo Pulp and Paper Company Limited
Daishowa Inc.
Emballages Smurfit-Stone Canada inc. – La Tuque Plant
Eurocan Pulp & Paper Company Limited
F.F. Soucy Inc.
Kruger Inc.
Lake Utopia Paper
Marathon Pulp Inc.
Maritime Paper Products Limited
Nexfor Inc.
Norske Skog Canada Ltd.
Paperboard Industries International Inc. (Division of Cascades Inc.)
Riverside Forest Products Limited, Armstrong Division
St. Marys Paper Ltd.
Stora Enso North America, Port Hawkesbury Mill
Tembec Inc.
Tembec Paper Group – Spruce Falls Operations
UPM-Kymmene Corporation
Weldwood of Canada Limited
West Fraser Timber Co. Ltd.
Weyerhaeuser Canada Ltd.

Rubber

Gates Canada Inc.
Michelin North America (Canada) Inc.
NRI Industries Inc.

Steel

Algoma Steel Inc.
AltaSteel Ltd.
Atlas Specialty Steels (A Division of Slater Stainless Corp.)
CHT Steel Company Inc.
Co-Steel LASCO
Dofasco Inc.
Frost Fence & Wire Products Ltd.
GenFast Manufacturing Co.
Gerdau Courtice Steel Inc.
Hilton Works (A Division of Stelco Inc.)
Ivaco Inc. (Ivaco Rolling Mills)
Lake Erie Steel Company (A Division of Stelco Inc.)
Laurel Steel (Division of Harris Steel Limited)
QIT – Fer et Titane inc.
Slater Steel Inc. – Hamilton Specialty Bar Division
Stelco Inc.
Stelco-McMaster Ltée
Stelfil Ltée
Stelpipe Ltd.
Stelwire Ltd.
Sydney Steel Corporation
Welland Pipe Ltd.

Textiles

Agmont Inc.
Albarrie Canada Limited
Barrday Inc.
Beaulieu Canada Inc.
Bennett Fleet (Quebec) Inc.
Britex Group (The)
C.S. Brooks Canada Inc. (Magog)
Cambridge Towel Corporation (The)
Cavalier Textiles
Coats and Clark Canada
Coats Bell
Collingwood Fabrics Inc.
Collins & Aikman Canada Inc.
Consoltex Inc.
CookshireTex inc.
Denim Swift
Fabrene Inc.
Glendale Yarns Inc. (or Glendale Spinning Mills (1981) Ltd.)
J.L. de Ball Canada Inc.
LaGran Canada Inc.
Lincoln Fabrics Ltd.
Manoir Inc.
Monterey Textiles (1996) Inc.
Nova Scotia Textiles, Limited
PGI-DIFCO Performance Fabrics Inc.
Spinrite Inc.
St. Lawrence Corporation
Stedfast Inc.
Velcro Canada Inc.
VOA Colfab Inc.

Transportation Equipment Manufacturing

Accuride Canada Inc.
Boeing Toronto Limited
Bombardier Inc. - Valcourt Plant
Cami Automotive Inc.
Canadian General-Tower Limited
DaimlerChrysler Canada Inc.
Ford Motor Company of Canada, Limited
General Motors of Canada Limited
Honda of Canada Mfg.
International Truck and Engine Corporation Canada
Oetiker Limited
Orenda Aerospace Corporation
Orion Bus Industries Inc.
Oxford Automotive, Inc. - Suspension Division, Chatham
Polywheels Manufacturing Ltd.
Pratt & Whitney Canada Inc.
Presstran Industries
Prévost Car Inc.
Rockwell Automation Canada Inc.
Russel Metals Inc.
Sterling Trucks, A Division of Freightliner Limited
Toyota Motor Manufacturing Canada Inc.
TRW Automotive
Volvo Cars of Canada Ltd.
Woodbridge Group (The)

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Alberta Food Processors Association

Aluminium Association of Canada

Automotive Parts Manufacturers' Association

Baking Association of Canada

Canadian Association of Manmade Vitreous Fibre Manufacturers

Canadian Chemical Producers' Association

Canadian Fertilizer Institute

Canadian Foundry Association

Canadian Gas Association

Canadian Lime Institute

Canadian Manufacturers & Exporters (CME)

CME Alberta Division

CME British Columbia Division

CME Manitoba Division

CME New Brunswick Division

CME Newfoundland Division

CME Nova Scotia Division

CME Ontario Division

CME Prince Edward Island Division

Canadian Meat Council

Canadian Petroleum Products Institute

Canadian Plastics Industry Association

Canadian Steel Environmental Committee (Canadian Steel Producers Association)

Canadian Textiles Institute

Canadian Vehicle Manufacturer's Association

Cement Association of Canada

Council of Forest Industries

Electro-Federation Canada

Food and Consumer Products Manufacturers of Canada

Forest Products Association of Canada

Forintek Canada Corporation

Mining Association of Canada

National Dairy Council

Ontario Food Producers' Association

Quebec Forest Industries Association

Rubber Association of Canada

The Canadian Council of Grocery Distributors

GLOSSARY OF TERMS

Annual Census of Mines

NRCan survey that collects information on SIC 06 and SIC 08.

Annual Survey of Manufacturers (ASM)

Statistics Canada survey. Provides information on the consumption of purchased fuels and electricity (only) for approximately 230 subsectors at four-digit SIC code levels.

Base Year

A reference year. For the Framework Convention on Climate Change, 1990 is the base year.

Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.)

VCR Inc. is a key element of Canada's National Action Program on Climate Change. It encourages the private and public sectors to take voluntary steps to limit or reduce GHG emissions. As a first step, participants are encouraged to submit a letter of intent confirming a commitment to limit or reduce GHGs from their operations. This is followed by an action plan and subsequent progress reports. The Industrial Energy Innovators Initiative provides a means for manufacturing and mining companies to enroll in VCR Inc.

Carbon Dioxide (CO_2)

A compound of carbon and oxygen that, in its normal gaseous state, is clear and colourless. CO_2 is formed whenever carbon-bearing fuels are burned. It can also be formed via other reactions not involving combustion.

Economic Energy Intensity

Energy consumption per unit of economic output.

Embodied Energy

The energy consumed to transform all upstream raw materials into the final product. In a life-cycle approach, it would be the "cradle to grave" energy burden.

Energy Intensity

Energy consumption per unit of output.

energy intensity Indicator

A dimensionless ratio equal to the energy intensity in a particular year divided by the energy intensity of the base year. The energy intensity indicator for the base year equals 1.0.

Energy Performance Measures

Any of a variety of metrics that would indicate an aspect of energy performance.

Framework Convention on Climate Change (FCCC)

United Nations convention to address climate change signed by more than 150 countries at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992. Canada became the eighth country to ratify the Convention, which entered into force on March 21, 1994, thereby committing to work toward stabilizing GHG emissions at 1990 levels by the year 2000.

Greenhouse Gas (GHG)

A GHG absorbs and radiates heat in the lower atmosphere that otherwise would be lost in space. The greenhouse effect is essential for life on this planet, since it keeps average global temperatures high enough to support plant and animal growth. The main GHGs are carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFCs) and nitrous oxide (N_2O). By far the most abundant GHG is CO_2, accounting for 70 percent of the greenhouse effect.

Gross Domestic Product (GDP)

The total value of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for capital consumption, labour and property located in Canada. It includes the total output of goods and services by private consumers and government, gross private domestic capital investment and net foreign trade. GDP figures are reported in real 1986 dollars.

Higher Heating Value

The amount of heat that is obtained when a specified amount of fuel is combusted with its stoichiometrically correct amount of air, both being at 15°C when combustion starts, and the products of combustion being cooled to 15°C before the heat release is measured (also called "gross calorific value" or "gross heating value").

Industrial Consumption of Energy Survey (ICE)

Statistics Canada survey on energy use. Covers purchased and non-purchased energy for approximately 24 industrial subsectors.

Lower Heating Value

The higher heating value minus the latent heat of vaporization of the water vapour formed by the combustion of any hydrogen present in the fuel. For a fuel with no hydrogen, the higher and lower heating values are the same (also called the "lower calorific value" or the "net heating value").

Natural Resources Canada (NRCan)

The predominant natural resources department of the Government of Canada. NRCan has a mandate to promote the sustainable development and responsible use of Canada's mineral, energy and forestry resources and to develop an understanding of Canada's land mass.

Physical Energy Intensity

Energy consumption per unit of physical output.

Quarterly Report on Energy Supply and Demand (QRESD)

Provides an energy balance of all energy consumption in Canada. QRESD data on the manufacturing industries are gathered mainly by the Industrial Consumption of Energy (ICE) survey. These data are supplemented by other surveys on the disposition of energy (from utilities) and the production of petroleum products.

Specific Energy (Consumption)

Energy consumption per physical unit of output (also called "physical energy intensity").

Standard Industrial Classification (SIC)

Statistics Canada uses a classification system that categorizes establishments into groups with similar economic activities.

Statistics Canada

Statistics Canada is the country's national statistical agency, with programs organized into three broad subject areas: demographic and social, socio-economic and economic. Under the Statistics Act, Statistics Canada is required to collect, compile, analyse, abstract and publish statistical information on virtually every aspect of the nation's society and economy. All information given to Statistics Canada through surveys, the census or any other source is confidential. Statistics Canada does not release any information that identifies an individual or organization.

Tier I

Informal designation by CIPEC of industries that are major energy-consuming industries. The seven designated Tier I industries are pulp and paper, petroleum refining, cement, mining, steel, chemicals and aluminum. The Tier I industries account for approximately 80 percent of total Canadian industrial energy consumption.

Tier II

Informal designation by CIPEC of industries that are minor energy-consuming industries (relative to Tier I industries) but contribute substantially to Canadian industrial GDP. Tier II industries account for 60 percent of Canadian industrial GDP.

CIPEC

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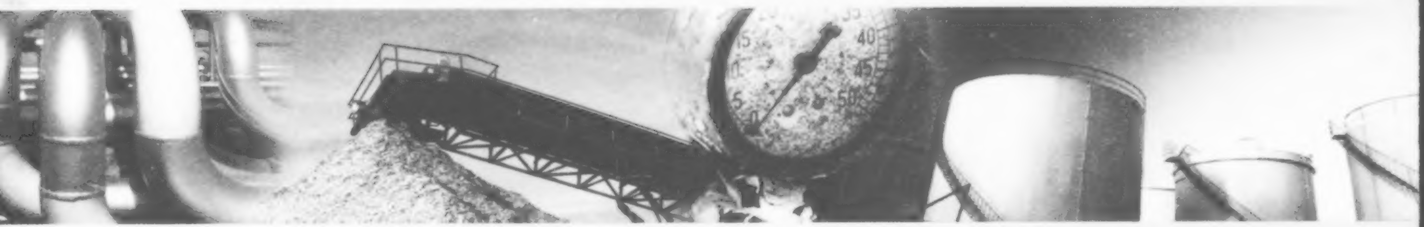

OEE

Office of Energy Efficiency
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Leading Canadians to Energy Efficiency at Home, at Work and on the Road

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